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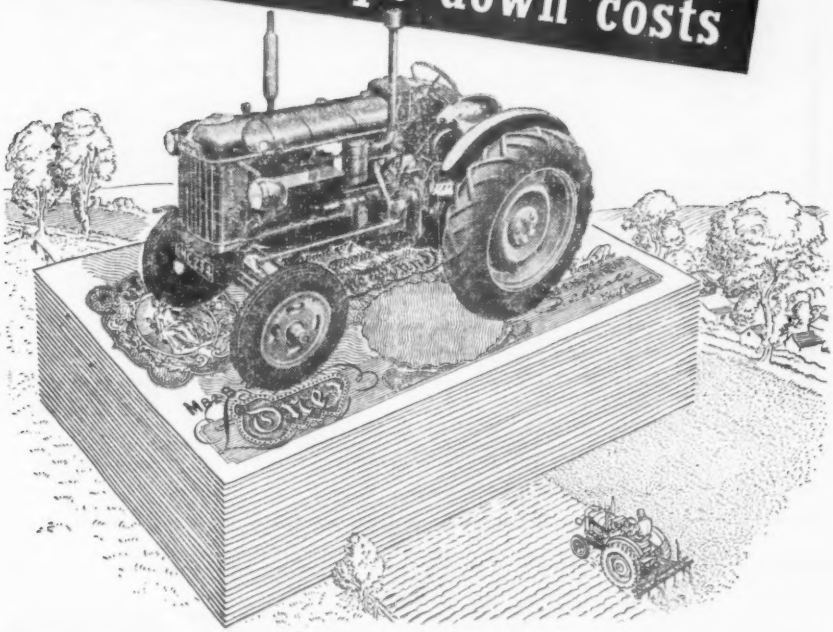

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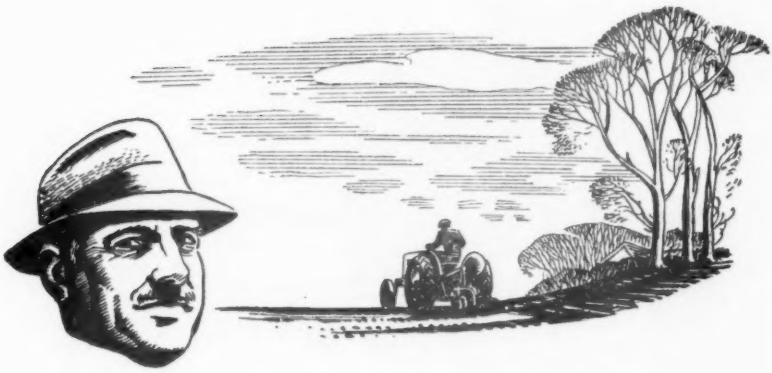

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VOL. LVIII No. 6 SEPTEMBER 1951

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AGRICULTURE

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

VOL. LVIII No. 6 SEPTEMBER 1951

THE SPRING GRAZING OF AUTUMN-SOWN CORN

D. H. ROBINSON, B.Sc., Ph.D., N.D.A.

National Agricultural Advisory Service, West Midland Province

From trials carried out in various parts of the country it appears that when autumn-sown corn is grazed in spring the ultimate yield of grain is likely to be reduced, although the application of nitrogen after grazing can reduce the loss. There is some compensation, however, in the rise in the milk yield when dairy cows are used for grazing.

THE reasons given for the spring grazing of autumn-sown wheat (or oats) seem to be contradictory. If the plants are backward and thin, grazing is sometimes recommended to " strengthen and thicken " the crop. Presumably what happens is that grazing encourages the plant to tiller through removal of the central growing shoot and through forcing the plants into closer contact with the soil. Whether the improvement in a thin crop said to be brought about by grazing could not be excelled by the use of the roller plus a top dressing of nitrogen must remain a matter of opinion until precise comparisons have been made with the usual experimental safeguards.

If in spring an autumn-sown cereal is abnormally luxuriant, or " winter proud," it is often grazed to reduce the excess leaf and so prevent the crop lodging or laying when the stems and ears develop. This removal of the "flag" enables light and air to get to the base of the stems and encourages healthy, "hard" growth. The evidence supporting the grazing of winter-proud corn is more positive than it is for the grazing of backward crops, though it is chiefly observational, for direct comparisons of grazed and ungrazed crops are not plentiful.

Since accurate information about the effect of grazing autumn-sown corn is so scanty, the Agricultural Improvement Council, in 1946, asked the County Technical Development Committees to arrange for simple trials wherever these were possible ; in subsequent years the investigations were continued by the National Agricultural Advisory Service. It had been hoped to carry out these trials on winter-proud corn ; but some seasons do not encourage luxuriant winter growth and winter-proud crops are not always available. The results described here have consequently been obtained from what may be called strong-growing but not over-luxuriant crops ; they were "grazable" crops, but not crops which one felt compelled to graze because they were too winter proud. This is an important point, because in the spring the dairy farmer, in particular, is often very tempted, because of shortage of keep, to graze a good-looking field of winter wheat or oats.

THE SPRING GRAZING OF AUTUMN-SOWN CORN

The original plan envisaged grazing early (about the end of March to the beginning of April) and grazing late (from about the middle of April to the beginning of May). It was not found possible to vary the grazing dates at some centres, and in any case variations in weather, both as regards season and situations of the centres, made it difficult to adhere to pre-determined times.

Grazing Reduces Yield In the East Midlands, trials were carried out in Kesteven (1948 and 1949) and in Northamptonshire (1949 and 1950). In all cases sheep were used, and the animals were confined to the grazed plots by wire. The plots were replicated, and to one-half of each plot a top dressing of 1 cwt. per acre sulphate of ammonia was given as soon as grazing ceased. Grazing dates were as follows :

Kesteven,	1948 :	early, March 31—April 5 ;	late, April 26—May 1.
,,	1949 :	early, March 30—April 6 ;	late, April 26—May 2.
Northants,	1949 :	early, March 22—April 13 ;	late, April 20—26.
,,	1950 :	early, March 24—April 2 ;	late, April 14—25.

The results are set out below :

Summary of the East Midlands Experiments

Centre	Yield per Acre (cwt.)					
	No Grazing		Early Grazing		Late Grazing	
	No Nitrogen	Nitrogen	No Nitrogen	Nitrogen	No Nitrogen	Nitrogen
Kesteven, 1948	26.8	30.9	28.7	31.0	20.2	23.1
,, 1949	26.2	*23.6	25.6	25.1	22.7	24.2
Northants, 1949	19.6	22.0	14.7	18.7	12.1	13.0
,, 1950	31.7	31.9	28.1	28.0	26.6	30.3
Mean	26.1	27.1	24.3	25.7	20.4	22.6

*After correction for loss of yield due to severe lodging on one plot, the value should be 26.0.

The trend is quite clear : on average, the early grazing has reduced the yield of grain by 2 cwt. per acre, and the late grazing by nearly 6 cwt. per acre. The application of nitrogen after grazing has, in the case of early grazing, brought back the yield to about that of the unmanured, ungrazed plots ; but on the late-grazed plots it has made up rather less than half of the grain lost by grazing.

Trials took place in the West Midlands near Worcester and Nantwich in 1949, and again near Nantwich in 1950. Dairy cows were used in all cases, and the animals were not confined as in the East Midlands trials, but had unlimited grazing except for the boxed-in, ungrazed enclosures. Nitrogen was not used. In the 1949 Worcester trial, in which the ungrazed plots were duplicated, grazing was spread out between April 5 and April 28 : it appeared to reduce the yield of wheat by about 4 cwt. per acre, worth, at the price then ruling (22s. per cwt.), approximately £4.

In the 1949 Nantwich trial, S.147 winter oats were grazed between April 11 and April 20. The yields were as follows :

	Yield per Acre	
	Grazed Plots	Ungrazed Plots
	cwt.	*cwt.*
Grain	19.4	25.0
Straw	21.0	36.0

Grazing seems to have reduced the yield of oats by about 5½ cwt. per acre, and of straw by 15 cwt. per acre. Taking the cost of production value of oats at 18s. per cwt., and of straw at £2 per ton, the grazing cost about £6 10s. per acre in terms of diminished yield.

In 1950, the Nantwich trial was repeated with wheat, using the varieties Holdfast and Redman. Grazing took place between April 22 and April 27 and amounted to about 60 grazing hours per acre. There was no top dressing with nitrogen after grazing, but the whole experimental area had received 1 cwt. per acre "Nitro-Chalk" on March 10. The results were :

	Holdfast		Redman	
	Grazed	Ungrazed	Grazed	Ungrazed
Weight of grain per acre (*cwt.*)	18.6	28.4	20.6	24.4

As in the 1949 Worcester trials, grazing materially reduced the yield of grain. Averaging the two varieties, the depression in yield was about 6 cwt. per acre of grain, which with wheat at 28s. per cwt., means a loss of £8 per acre. It would take nearly 70 gallons of milk per acre (at 2s. 4d. per gallon) to offset this loss.

In a trial carried out in Monmouth during 1948, a field of S.147 winter oats was divided into three plots and grazed with dairy cows, and later with in-calf heifers, with the following results. A top dressing of 1 cwt. sulphate of ammonia was given to one-half of each plot after grazing had finished.

Results of Trial at Monmouth in 1948

	No. of Grazing Days per Acre	Yield per Acre (cwt.)	
		No Nitrogen	Nitrogen
Grazed early (April 12-16) ..	190	15.5	18.2
Grazed late (May 5-19) ..	990	2.4	4.9
No grazing ..	—	18.5	21.2

At this centre early grazing reduced the yield by 3 cwt. per acre, a loss which was recovered by top dressing with nitrogen, compared with an ungrazed crop given no manurial after-treatment. The late grazing was obviously extremely heavy* and destroyed the plant as a grain producer, as one might have expected.

Milk Yields Stimulated The stimulating effect of a cereal on milk yield is brought out by the following figures. In the week before the early grazing, a herd of sixteen Shorthorn heifers grazing a rough meadow yielded 2,970 lb. of milk ; during the week of early grazing (April 12–18) the yield was 3,106 lb., an increase of 136 lb.

The same trend towards lower yields of grain after grazing has been shown in small plot trials at Wye College, reported by Mr. David H. Peto. In a trial in 1950 where dairy cows were used, there was a reduction in yield of wheat from a late March grazing of about 4 cwt. per acre. The stimulation

* The report states that by May 19 the plot was then " fairly tightly grazed".

of milk yield was remarked upon. When sheep were used in another trial, grazing from April 21 to April 28 reduced the yield by 23 per cent (10.3 cwt. per acre on a 44.9 cwt. crop). The application of 1 cwt. per acre sulphate of ammonia immediately after grazing reduced this loss to about 12 per cent, and 2 cwt. per acre reduced the loss to 6 per cent, compared with the ungrazed, no nitrogen plots.

These investigations so briefly mentioned here were not precise in the scientific sense, and in some cases they lacked the replications desirable in this sort of investigation ; yet they all agree in showing that the spring grazing of winter-sown corn, if practised after the end of March, is likely to cause reduced yield. (It must again be emphasized that these observations refer to autumn-sown cereals which were not winter proud.) The results suggest that if grazing is continued into mid- or late April, the loss of grain may be as high as 6 cwt. per acre, or 20–25 per cent of the potential crop. They also emphasize the desirability of top dressing grazed crops with at least 1–1½ cwt. per acre sulphate of ammonia immediately the grazing has finished, since this is likely to reduce the loss of grain by up to one-half.

FODDER BEET: A GENERAL REVIEW

W. E. H. FIDDIAN, M.A.

N.I.A.B. Regional Trials Officer,
Norfolk Agricultural Station, Sprowston

Formerly a neglected crop in Britain, fodder beet is now receiving much more attention, although on the Continent it is a basic crop for the feeding of livestock. The following article, reviewing the existing knowledge of the crop in this country, is based on experience in Norfolk and on information obtained from Denmark and Holland.

THE term " fodder beet " has been variously used to cover a wide range of roots—from mangold types of relatively low dry matter content to plants which are outwardly barely distinguishable from a sugar beet and have a dry matter content of up to 23 per cent. In both Danish and Dutch classifications three main groups are recognized. In Denmark these are (*a*) the Barres-type mangolds (less than 15 per cent D.M.), (*b*) the fodder sugar beets (15–20 per cent D.M.), and (*c*) the sugar beets for fodder (over 20 per cent D.M.).

Nomenclature has not yet been agreed in this country. The English translations of the Danish terms are clumsy and confusing, and the classification does not take into account the depth of root in the soil—an important point to the prospective grower in relation to his method of harvesting. The ultimate decision on this problem will rest with the National Institute of Agricultural Botany. At the best there can be no sharp division between groups since nearly every gradation exists, especially in the two lower dry matter groups, and furthermore, it is not uncommon for the dry matter content of a particular strain to vary by as much as 3 per cent according to season and environment. In this article the Danish classification is used.

The Barres-type mangold mostly resembles an orange mangold with an intermediate or tankard-shaped root, but has a rather higher dry matter content than many of our mangolds and a larger top suitable for feeding.

The fodder sugar beets all originate from mangold-sugar beet crosses. They vary in shape of root and in colour of flesh and skin, but sit rather further in the ground than our mangolds. The sugar beets for fodder closely resemble sugar beet, and may sit nearly as far in the ground, but it should be noted that there are also fodder sugar beets with a white skin.

Field trials have shown that certain strains of fodder beet will outyield the majority, if not all, of our own mangolds in dry matter per acre. Hunsballe, a sugar beet for fodder which is being grown commercially in this country, is an example.

In Table 1 the average yield of this strain in the Danish trials is compared with yields of crops which fodder beet might replace in the feeding of pigs or cattle. It should be made clear that the yields quoted for mangolds, swedes, potatoes, kale and barley are purely hypothetical, although, with the exception of barley, they are in fact about 50 per cent higher than the national ten-year averages.

Table 1

Comparisons in Yield of Dry Matter

	Yield	Percentage Dry Matter	Yield of D.M.
	tons per acre		*tons per acre*
Hunsballe roots	20	20.3	4.1
Hunsballe tops	10	13.5	1.3
Hunsballe Total Crop	30	—	5.4
Mangolds	30	12.0	3.6
Swedes	18	12.0	2.2
Marrowstem kale	30	14.0	4.2
Potatoes	10	24.0	2.4
Barley	1	86.0	0.9

This table shows that the fodder beet compares favourably with other crops in production of dry matter per acre, but in comparison with kale, the yield of crude protein per acre will probably be less.

Advantages and Disadvantages of Fodder Beet

Fodder beet is not as popular in this country as it is on the Continent. In Denmark it has been in general use for about twenty years, and today there are 4½ acres of fodder beet for every one of mangolds. In the following paragraphs the remarks refer more particularly to the high dry matter strains.

Compared with most mangold strains, a higher yield of dry matter per acre can be obtained from little more than half the weight of roots. This means a big saving in labour at harvest time, which, however, is to some extent offset if it should be necessary to clean the roots.

The roots are particularly suitable for the feeding of stock such as pigs, which cannot, with their small stomachs, make efficient use of such bulky foods as mangolds. The tops are a valuable feed, comparable in yield and analysis with those of sugar beet.

Fodder beet is often fed immediately after lifting, apparently without harm, and the crop can therefore be pulled and carted without the necessity of topping, so that a more balanced feed results. (Mangolds are not usually fed until after Christmas because their amide content may lead to digestive trouble.)

Fodder beet is relatively free from damage by autumn frost while it is in the ground. During the Norfolk survey several growers ranked high the fact that when fodder beet is grown, there is no need to interrupt the lifting of sugar beet in order to save the crop (as with mangolds) from the first frosts. There is evidence, however, that the dry matter content of the roots decreases if they are left in the ground during the winter months.

The results of keeping-quality tests carried out in this country suggest that the higher dry matter strains store better than mangolds in the clamp. On the Continent roots are often kept in the clamp until the following May or June, but it should be noted that the crop is subject to Virus Yellows and therefore the rules of clamp hygiene should apply as with mangolds. It would appear probable that fodder beet are not as susceptible to bruising as mangolds.

Against the above advantages of fodder beet must be set two disadvantages which may be serious with certain strains. It has already been mentioned that the sugar beets for fodder sit fairly well in the ground. Except on very light land, it is not practicable to pull these by hand. Moreover, these roots, like sugar beet, will almost certainly require knocking, and may even have to be put through a root cleaner either before or after clamping. The fodder sugar beets can normally be lifted by hand, but may require additional cleaning when grown on heavier soils.

Choice of Strain The strains of fodder beet available in this country at present are mostly of Danish origin. In Denmark the most promising strains from each four-year trial series are admitted into the First Class and allotted the Roman numeral of the current series. Thus the First Class strains resulting from the 1944–47 trial series all carry the numeral X, e.g., Hunsballe X. The stocks of White Øtofte grown last year bore the numeral IX, since this strain did not survive the 1944–47 trials, and is consequently now practically unsaleable in Denmark.

Some of the strains most likely to be met with in 1951 in this country are set out in Table 2, together with certain aspects of their performance in the official Danish trials. Experience with other crops shows that the comparative behaviour of varieties on the Continent and in this country may differ, so that this table should be taken only as a general guide.

It will be seen that differences between the fodder sugar beets and sugar beets for fodder in ultimate yield of dry matter per acre do not vary widely, and until further work on this subject has been carried out in this country, the choice of strain will depend largely on the type of root required.

It must be assumed at present that the field treatment of fodder beet must vary, according to the type used, between that normally accorded to mangolds and to sugar beet. Work in Denmark suggests that the response of the higher dry matter strains to lime, farmyard manure and common salt is similar to that of sugar beet. This is also probably the case with other inorganic fertilizers, although it appears from Danish trials that the higher yield of dry matter per acre from the fodder sugar beets does not necessarily mean a greater intake of NPK.

Table 2

Extracts from Danish Variety Trials 1944-47

	Yield		Dry Matter				Lifting 0=difficult 10=easy
	Roots	Tops	Roots	Tops	Roots	Tops	
	tons per acre		*tons per acre*		*percentage*		
Barres Mangolds							
Øtofte X	27.3	8.4	3.87	1.06	14.2	12.6	8.2
Stryno X	32.4	9.2	3.85	1.16	11.9	12.6	8.4
Fodder Sugar Beet							
Red Øtofte X	23.6	9.7	4.15	1.24	17.6	12.9	6.1
Yellow Daeno X	25.9	10.1	4.07	1.26	15.7	12.5	5.7
Pajbjerg Rex X	21.0	11.0	4.00	1.46	19.1	13.2	4.3
White Øtofte	22.0	10.1	4.01	1.31	18.2	12.9	4.7
Sugar Beet for Fodder							
Hinderupgaard X	20.0	9.6	4.11	1.38	20.5	14.4	2.4
Hunsballe X	20.0	10.3	4.05	1.40	20.3	13.5	2.9
Pajbjerg X	19.2	10.8	4.01	1.50	20.9	13.9	2.4

Danish work on spacing is based on higher root populations than those likely to be adopted in this country, but for the smaller-rooted types row-width should be reduced to 20–22 inches, with 10–12 inch spacing between the plants. The seed rate should be 12–15 lb. per acre for these strains ; the seed is no more expensive than that of mangolds.

Trials in both Denmark and Holland show that drillings in the first week of April gave yields 15–20 per cent greater than those in the first week of May. It is recommended that in Britain seed should be sown in late March or early April, except in the North, where a later sowing may be desirable to counteract the possibility of excessive bolting.

Harvesting, Storage and Utilization The Norfolk survey included one or two instances of Hunsballe being hand-pulled without difficulty on very light land. Normally, however, the sugar beets for fodder must be dug with the beet fork, ploughed out, or lifted by mechanical harvester. This adds to the cost of the crop, but the increasing use of the more simple Continental two-stage harvesters in the main sugar beet areas may have an important bearing on future sowing of this type. No alteration to these harvesters should be necessary, apart from a slight adjustment to the height of the topping mechanism, but adequate cleaning of the roots is very important.

On the Continent fodder beet of lower dry matter, standing fairly well out of the ground, are commonly lifted by a simple type of machine not seen in this country. With these strains, however, the possibilities of mechanical lifting are limited by the difficulties of topping the roots without pushing them over, and this operation is usually carried out with hand topping-hoes.

In Denmark it is normal practice to remove the tops with the crown of the root, as with sugar beet. It is considered that the roots are less likely to rot in the clamp if this is done, and indeed, it is almost essential if the tops are subsequently to be handled for feeding.

In Britain fodder beet would normally be clamped like mangolds, but it

remains to be seen how much earthing-up is necessary to protect them from frost. Danish work shows that considerable loss from heating can occur if the clamps are covered too soon.

On the Continent fodder beet are fed to pigs, horses, fattening cattle and dairy cattle. For pigs the chief advantage of the crop is lost unless a strain with a high dry matter content is used. For cattle a fodder sugar beet such as Red Øtofte X may be found more suitable. Dutch farmers apparently dislike a root with a high sugar content for dairy cattle, and there have been reports in Britain that roots of a type such as Hunsballe are too hard to feed whole to cattle.

Up to 85 per cent of the dry matter in the roots may be in the form of soluble carbohydrate, mostly sugar, and 5–7 per cent may be crude protein. Dutch work shows that whereas there is a close correlation between the sugar and dry matter content of strains (the one rising or falling with the other), the crude protein shows less variation. In the two Dutch groups lowest in dry matter (10–17 per cent D.M.), the crude protein content averaged 6.3 per cent of dry matter, but in the next group (17–23 per cent D.M.) it was only 5.3 per cent. Furthermore, it was shown that where environmental conditions lowered the dry matter content of a strain, the crude protein increased in proportion.

The feeding value of fodder beet for pigs is closely akin to that of potatoes, but about 5–6 lb. of sugar beet for fodder replaces one pound of meal, as against 4½ lb. of cooked potatoes. Two independent accounts of trials at Reading and Wye on the feeding of fodder beet to pigs have appeared in this JOURNAL ([1],[2]). In both cases pigs fattened on an all-meal ration were compared with others fed on the Lehmann system in which a daily ration of 2½ or 3 lb. of meal was supplemented to appetite with sliced fodder beet. At Reading a further group of pigs received mangolds in place of fodder beet. Both centres showed that the growth of pigs receiving fodder beet was similar or only slightly inferior to that of pigs receiving an all-meal ration, and at Reading the value of mangolds as a supplementary food was definitely inferior.

In all the trials the saving of meal with the groups receiving fodder beet was 50–56 per cent. Pigs were receiving up to 20 lb. of roots per day, and no trouble was experienced with their health. It was pointed out, however, that the inclusion of a high protein concentrate in the meal was essential, and that 15–20 per cent fishmeal is probably necessary for this purpose. Examination of the carcasses showed no significant differences between groups, except at Reading, where the fat from the pigs receiving meal only was less firm than from those receiving fodder beet, probably due to the high proportion of flaked maize in the meal. Further experience has shown that up to 30 lb. of fodder beet per day can be fed to breeding sows if introduced gradually.

Feeding Untopped Roots It has been mentioned that the Danes often cart and feed untopped beet in the autumn. In the Norfolk survey two farmers were using this method for their breeding sows with some success, while a third, Mr. D. Green, of Hall Farm, Snetterton, folded twenty sows between farrowing on a ¼-acre piece of Hunsballe with an electric fence.

The latter experience is of some interest. In order to make the change-over in feeding more gradual, the folded sows received daily, in addition, about 10 lb. of potatoes, and also occasional sheaves of spoilt barley. They

showed considerable interest in the barley straw long after the grain had been picked out, and this may indicate the need for the inclusion of food of a more fibrous nature. The sows remained on the beet for a month, causing very little waste and pulling up the roots without difficulty. There were no signs of ill-health, and in view of their remarkably good progress, Mr. Green subsequently cut down their normal steaming-up period from three weeks to one.

Feeding untopped roots means that the tops cannot be satisfactorily wilted. From our limited information it would appear that the danger of feeding fodder beet tops alone without the usual precautions is no less than with sugar beet. Where, however, the crop is fed whole, the proportion of tops to roots will seldom exceed one to four on a dry matter basis, and the danger is thus minimized. The need for caution, however, cannot be too strongly stressed, and the feeding of untopped roots should be introduced gradually. The feeding of tops alone will be the same as with sugar beet tops. On the Continent a large proportion of the tops are ensiled.

The feeding of topped roots to cattle appears fairly straightforward, but it is important in the case of the strains with a high dry matter content that the yardman should understand that the quantities fed should be only about half those of mangolds.

References

1. Pig-Feeding Trials at Wye with Fodder Beet. A. C. DUNKIN and M. M. COOPER. *Agriculture*, 1949, **56**, 364-9.
2. Fodder Beet for Fattening Pigs. R. BRAUDE and K. G. MITCHELL. *Ibid*, 1949, **56**, 369-74.

State Aid for Woodland Owners

A useful booklet has just been published by the Forestry Commission entitled *State Aid Available to Woodland Owners*. Sections are devoted to the Dedication Scheme, Small Woods Planting Grants, Popular Planting Grants and Thinning Grants. A list is included of the Directors and Conservators of Forestry, from whom woodland owners can obtain advice on any forestry problems. The booklet is obtainable free from the Forestry Commission, 25 Savile Row, London, W.1.

AFTER THE RESTORATION: STUART SQUIRES, MANORS AND FARMS

A paper read to the Royal Stuart Society at their Anniversary Dinner celebrating the Restoration of Charles II.

G. E. FUSSELL, F.R.Hist.S.

AT Charles II's restoration agriculture was in a very rude and imperfect state. Not more than half the kingdom was farmland ; the rest was moor, forest and fen. Many roads that in 1848 passed an endless succession of orchards, hayfields and beanfields in 1660 traversed nothing but heath, swamp and warren. Nearly ten million acres had been reclaimed by hard toil in two centuries. This was a remarkable achievement, firm foundations for which were laid immediately after the restoration by the landowners great and small, who came back to live on their manors. Not one in twenty went to Town once in five years, or, with the exception of the refugees, had ever in his life wandered as far as Paris. Often their education differed little from that of their menial servants, and they had no better tutors than grooms and gamekeepers. A gentleman who went to school and college returned to the seclusion of the old Hall and the care of his property before he was twenty, and plunged into the necessary business of a practising farmer. He examined samples of grain, handled pigs, and, on market days, made bargains over a tankard with drovers and hop merchants. The litter of the farmyard gathered under the windows of his bedchamber, and cabbages and gooseberry bushes grew close to his hall door. His table was loaded with unrefined plenty, and guests were cordially welcomed to it. But coarse as was their life in some ways, these men formed a proud and powerful aristocracy whose influence upon the conduct of moral affairs it is difficult to overestimate.

This quality of aristocracy was demonstrated in their virility, their love of manly sports, their stoicism and their ability to mix with their fellow men, and the English country gentlemen of the restoration were cultured. "They built commodious and classical houses for themselves and their posterity, filled them with treasures of art, encompassed them with walled gardens to catch the sunlight, made fountains, pastures and grottoes, and planted walks of beech and sycamore." They were patrons of literature and learning.

Of course they varied. Doubtless many country gentlemen were like those immortalized by Goldsmith as Tony Lumpkin and Fielding as Parson Trulliber, but many were of the quality of Evelyn, the diarist, one of the most influential men in the Royal Society, and author of those fine books, *Terra*, *Sylva* and *Pomona*, wherein he treats of soils, of forestry and of cider. His manor house has now been bought for the Coal Board.

New Ideas from Abroad Surrey, where Evelyn lived, was the home county of another great country gentleman, Sir Richard Weston of Sutton Court. He was probably out of England during the Civil Wars, and he brought back ideas for improved farming learned in the Netherlands. These ideas he embodied in a manuscript acquired and published by that Polish or German *entrepreneur* of the Commonwealth, Samuel Hartlib, who made an apology for publishing it as his *Legacie* because he did not know who wrote it when he acquired it.

Weston was not, of course, the first man to preach a longer crop rotation. Tusser proposed it a century before, but earlier writers, and, indeed, contemporaries like the Roundhead Capt. Blith, were more concerned with what

is now called ley husbandry ; not leaving land in permanent pasture that degenerated, nor ploughing the same land for too many years in succession so that yield declined. Weston brought home knowledge of the field culture of turnips, which were used by the "Boores" of Flanders for cattle feed, and of the use of clover as a rotation grass. He tried his theories at Worplesdon. His manor house is still standing, though reduced in size. This idea of intermixing a year or so of grass, and of alternating a crop of roots with a crop of corn, made great intensification of farming possible in the eighteenth century, and made British agriculture the foremost in the world in the nineteenth.

I wonder whether Sir Richard Weston and John Evelyn ever met, or whether either of them met John Worlidge, gent., of Petersfield in the neighbouring county of Hampshire. Of Worlidge's life nothing is known, except that he lived at Petersfield and wrote a fine book on farming in 1669. In it he tried to collect and arrange systematically the knowledge of his day. He advises all sorts of practices that could only have been theory, and very rarely says where these things were commonly done. When he does, they usually are old established methods like the use of sea sand for manure in Devon and Cornwall—a practice well known for at least a century before, and still usual. He does say that sainfoin (or Holy Hay) had been cultivated in Wiltshire extensively during the previous twenty years. Legend has it that when the Christ Child was born at Bethlehem he was laid in a manger filled with sainfoin. When He awakened His parents they were astonished to find the dry hay had blossomed. The babe was festooned with its beautiful red flower. Indeed in some parts of the Down country sainfoin was preferred to clover. This shows how eagerly the Stuart farmers of the Chalk Downs had adopted a plant that would enable them to keep more stock. Worlidge was, of course, a protagonist of turnips also, but believed that they were grown more commonly in gardens than in fields, although a tithe of turnips grown in the fields was taken at that time in Godalming. Richard Blome, a London compiler of magnificently produced subscription books, takes the opposite view in his *Gentlemen's Recreation* (1686). He indicates that not only was the crop grown more commonly in fields than in gardens, but it was generally a second crop on one ploughing, and must be twice hoed. Turnips mellowed the ground, and fitted it for another crop, were best sown after peas and beans, and were excellent feed for cattle and sheep, especially in frosty weather. Thus the new crops that were to make the great eighteenth century advances in farming possible were already grown in the reign of Charles II, but just where it is difficult to determine.

An Early Farm Survey John Evelyn and the other members of the Royal Society appointed a " Georgicall Committee " in 1664 to make inquiries. The project was ambitious in the extreme—no less than to compose a history of farming, and to secure complete details of contemporary practice in England. Since the procedure adopted was the familiar one of sending out a questionnaire for voluntary answer by farming and landowning personalities, the inquiry was not wholly successful, but some information was gathered.

This inquiry discloses that both red and white clover were grown near Ashford, Kent, and Nicholas Toke, a landowner in that county, bought clover seed in 1653, and in 1678 paid for pulling two acres of turnips. If he grew these crops on his manor farm probably other people in the county did too, but the probability must not be exaggerated. In the neighbouring county of Sussex the old wheat-bean-fallow rotation of the clays had been

changed to two successive corn crops, followed by a three-year ley of clover and "ray" grass, but how many people adopted the practice we do not know.

The most usual crops all over the country were wheat, oats, barley, beans, peas and rye, and in many counties, especially Kent and the south, tares and vetches were grown for feeding green to horses. Oats were more common in the south-west, the West Midlands and the north. Rye was still widely grown for human food, and of course geographical conditions determined the crops it was possible to grow then just as they still do. Roughly speaking, the agricultural regions of Charles II's day were the same as they are now, though every allowance must be made for the unreclaimed moor, heath and marsh that then prevailed everywhere.

East Anglia exported corn, which the gentry of Norfolk sent to Holland ; Cambridge, Bedford and Huntingdon sent it overland to London via the markets of Bedford, St. Neots and Royston. Farnham in Surrey, too, was a great wheat market, whence the grain was carried by wagon to Sir Richard Weston's canalized river Wey, and thence by barge to London. Wheat came down the Thames from the Vale of the White Horse via Abingdon and Henley, and the Severn and the Wye carried stores of grain from Hereford and Monmouth, and from the West Midlands to Bristol.

Cattle and sheep walked to market, and the drovers from the Welsh hills, the south-western counties, and the rich grazing of Lincoln and Buckinghamshire, as well as from Norfolk, were continuously on the road between the breeding farms and the grazing lands and on to the markets of London with the finished product. Sheep came from Leicester, the Cotswolds, Wiltshire and Dorset, where folding in the corn grounds was already the practice. Pigs walked to London from Devon and Hampshire.

Liquid milk was produced in the towns where it was needed, because it could not be kept fresh. Elsewhere the dairy farmers of Cheshire and the West Midlands, of Gloucester and the south-west, of Suffolk, made butter and cheese which was sold to factors, many of whom acted for the early combine known as " The Cheesemongers of London."

Cider was made much more widely than it is today. Hops were already established in Worcester and Hereford and in Kent, though some were grown in Essex and Yorkshire. Horses were bred by the Leicester and Northampton squires and farmers, though the Cleveland bay had not yet achieved the fame that it did later. Flemish horses were still preferred by those gentlemen whose heavy coaches rumbled over the cobbled streets of London.

The sight of a flock of geese or a drove of turkeys provided with leather shoes to protect their feet from the roughness of the way, marching along the roads to market, would rouse a smile in modern England, but it was a common sight in the autumn of the years when Charles II was king.

Dainties were often recognized by the places where they were produced: Hampshire honey and bacon, Derby ale, Tewkesbury mustard, and many others, were praised in England, and not unknown in other countries.

The results of the Royal Society inquiry were incomplete, as such inquiries mostly are unless made in person, and it was not until the Board of Agriculture was established in the late eighteenth century that a complete survey of rural England was made. Robert Plot set himself the task of supplying this deficiency. He decided to write a series of surveys of the natural history and antiquities of each county in England. This was an impossible task, even for the energies of a Carolean country gentleman, but Robert managed to complete two counties, Oxford in 1676 and Stafford ten years later in 1686.

At this rate of progress it would have taken him 400 years to finish the job, so his plan was a trifle optimistic.

The Oxford farmers in the heavy clay were busy with improvements. They sowed vetches or peas and then laid the land down with "ray" grass. Land was chalked and then repeatedly cropped until only fit for ley. Stone chips, probably limestone, were used for manure at Hornton, and Taylor's Shreds, which I suppose to mean woollen rags, were used at Watlington, the two Britwells and elsewhere in the neighbourhood. Liming had been common in Derbyshire a decade before, lime burning having been introduced there by Mr. Hammond of Worthington, but certainly not for the first time.

The Manors Develop their Amenities It is very evident that Restoration manorial lords and tenants alike were pushing on with the improvement of their estates, and doing all they could to increase the saleable output from their lands. Besides this activity, lords of manors were busy developing amenities. Many books on gardening and even more ambitious works like Richard Blome's *Gentlemen's Recreation* were produced. New fruits were being introduced and orchard culture was developing. Few manors were fully equipped that did not have an orchard. England was renowned for its apples and its cider, and perhaps the returning Cavaliers may have brought home with them a fuller knowledge of fruit growing. The plum, the pear, the peach and even the melon became familiar in the orchards and hot-houses, and on the manorial dining-table, where most things seen were home-produced. "So there grew up a literature of Pomona, and if a man failed to grow apples profitably he might nevertheless write about their culture with acceptance and even applause." The planting of forests was promoted by another branch of literature in which John Evelyn's *Sylva* played as prominent a part as his *Pomona* did in the world of fruit.

From the earliest records, Englishmen have been known as lovers of flowers, and the quiet gaiety of the old English garden was extended in this age by the introduction of the tulip from Holland, whence also the lily of the valley and the carnation may have been brought. The rose family expanded with the Provence and the Jericho, but the old favourites, the wallflowers, the violet, the hyacinth, the Madonna lily, and the daffodil among others, were still lovingly tended. And the instinct that sought for new flowers and their more effective display welcomed new trees and shrubs. As the great houses of the nobility were built, or rebuilt, the open spaces around them were decorated with fountains, avenues, canals, fishponds and orchards; and Althorp, Cassiobury, Cliveden, Euston, Ham and Swallowfield were places where the English formal garden was already to be seen.

To the upper classes at least the reign of Charles II brought keener and more educated appreciation of a well-ordered estate or a colourful garden; and his reign marks an important stage in the evolution whereby the English countryside has become the most varied and attractive in the world.

DNBP FOR THE CONTROL OF WEEDS IN PEAS

H. A. ROBERTS, B.Sc., and E. K. WOODFORD Ph.D., M.A.

Agricultural Research Council Unit of Experimental Agronomy, University of Oxford

Experiments in the use of DNBP for the destruction of annual weeds in the pea crop have been conducted at Oxford since 1946. Care must be taken in deciding the rate of application and the time of spraying, since some varieties of peas are more susceptible to injury from the chemical than others.

ALTHOUGH DNOC (3:5-dinitro-ortho-cresol) has been in use as a selective herbicide for cereal crops in this country since the early 1940s, it was not until quite recently that the phytotoxicity of higher members of the series was investigated. In 1945, however, Crafts in the United States published an account of experiments with several of these compounds, and showed that DNBP (2:4-dinitro-6-secondary butyl phenol) was the most toxic of those tested. In the same year it was also reported that DNBP in the form of the ammonium salt had proved promising for the selective control of annual weeds in crops of peas grown for canning. To determine the suitability of DNBP for this purpose under British conditions, experimental work was begun at Oxford in 1946, and the investigations have been continued until the present time. Simultaneous research by commercial enterprises led to the appearance on the British market of preparations based on DNBP, and growers have now been able to acquire two years' experience of the use of DNBP in the field. It is not the purpose of this article to give practical recommendations (these have already appeared in the Ministry's *Advisory Leaflet No.* 376), but rather to review the present state of knowledge and examine some of the factors involved in the selective action of DNBP in relation to the pea crop.

The Chemical Itself While chemically similar to DNOC, DNBP differs in certain biological properties ; it is more toxic to most annual weed species, but is less toxic than DNOC to peas and a number of other leguminous crops. Like DNOC, DNBP is toxic to animal life and is highly poisonous to man, so that great care should be taken when it is being handled or sprayed (see *Advisory Leaflet No.* 374). DNBP is itself only slightly soluble in water, but the ammonium salt forms a true solution at herbicidal concentrations, and it is this salt which is the active principle in the preparations at present available commercially. Comparisons of DNBP in aqueous suspension with solutions of the ammonium salt have not shown large differences in effect on plants, but the salt is usually more toxic both to peas and various species of annual weeds.

As with many other herbicides, formulation presents a problem. It is desirable that DNBP should be available in concentrated form in order to facilitate transport, but that the difficulties involved in dilution of suspensions should be avoided. The manufacturers have overcome this problem by taking advantage of the greater solubility in organic solvents, and formulating DNBP as a concentrated solution in a solvent such as acetone or an alcohol. In the final spray solution the particular solvent employed will usually be present to the extent of about 1 per cent, and tests at Oxford with acetone and ethyl alcohol indicate that such concentrations do not seriously affect the selective action of ammonium DNBP. Other substances which

may be present in a commercial preparation may affect the wetting and penetrating properties of the spray, so that it is advisable always to follow closely the manufacturers' recommendations as to the rates of application.

DNBP is not a growth-regulating substance. It is not translocated within the plant, and in consequence, is of little use in controlling perennial weeds. As its effect is confined to the leaves on which the spray falls, good coverage is essential. For this reason, and also because it is sparingly soluble in water, DNBP is suitable for use only in high volume applications of the order of 80–100 gallons per acre.

Entry of DNBP into the plant is gained by the penetration of the cuticle and epidermis and also, to a certain extent, by gaseous diffusion through the stomata. The toxic effect of the spray on plants is relatively rapid, like that of DNOC. With certain species of weeds, however, it has been reported that DNBP can cause a slow poisoning and our understanding of its toxic action in plant cells is far from complete. It is not certain how far the effect is attributable to precipitation of the protoplasm and how far to interference with respiratory and other systems. Nor is there yet an explanation of the selective action of DNBP in any crop and weed association. The relative resistance of peas may be due partly to the protective wax layer which reduces the retention of spray droplets, but since this would operate equally for sprays of DNOC, where the selectivity is much less, other factors must be involved. It is hoped that the work now in progress at Oxford may throw some light on such problems.

Factors Affecting Selectivity Preliminary work has shown that there is only a small margin of safety between the amount of DNBP required to kill weeds and that which causes severe injury to peas. Determination of the optimum dosage rate is therefore of great importance. A number of experiments have been carried out covering a wide range of rates of application to pea crops with various weed populations. The results of two of these are shown in Table 1, where the yields

Table 1

The Effects of Different Application Rates of DNBP on the Yield of Peas

Rate of Application	Yield of Threshed Peas (Harrison's Glory)			
DNBP	Expt. 1		Expt. 2	
*lb. per acre**	*cwt. per acre*	*per cent*	*cwt. per acre*	*per cent*
1.0	24.8	112	9.8	116
1.6	27.9	123	10.3	121
2.4	26.6	117	10.4	123
3.8	23.7	106	9.8	116
6.0	23.0	102	6.0	71
Control mean	22.65	100	8.5	100
Sig. Dif. (P=0.05)				
Between spray treatments	3.7	—	3.1	—
Between one treatment and control mean	3.2	—	2.7	—

*Sprays applied at 100 gallons per acre

have also been expressed as percentages of the mean yield of the untreated control plots, in order to facilitate comparison. In the first experiment, the dominant weed was chickweed (*Stellaria media*), which by reason of its low-growing habit does not compete strongly with peas, and in the second experiment there was a sparse stand of charlock (*Sinapis arvensis*). In both trials the highest yield was given by a dosage rate of about 1½–2 lb. of DNBP per acre ; the higher rates injured the crop with consequent lowering of the yield. Even under these conditions where the intensity of weed competition was low, increases in yield of 20 per cent were obtained with the best treatments. Where dense infestations of strongly competitive weeds such as wild radish (*Raphanus raphanistrum*) are present, spraying may mean all the difference between a good crop and no crop at all.

The increase in yield to be expected is also related to the stage of development of the crop and weeds at the time of spraying; as the resistance of both increases as development proceeds, choice of the best time to spray is a matter of striking a balance. If the application is too early, the crop may be injured by the spray, if it is delayed too long, the degree of weed control achieved may be low. Experiments in which peas have been sprayed at different stages of growth indicate that, with an application of 2 lb. per acre, a height of 4 inches is the earliest stage at which spraying can safely be carried out. Under some conditions, however, this amount has been successfully applied when the peas were only 2 inches high, and where the dominant weeds are relatively resistant, spraying before the peas reach a height of 4 inches may be a risk well worth taking.

Weed species vary in their response to DNBP, and in Table 2 a number of annual weeds of common occurrence in pea crops are listed in decreasing order of susceptibility. Plant heights are given for the latest stages of growth at which a satisfactory control may be expected. It should be realized, however, that these figures are merely convenient estimates of the stage of plant development and should not be interpreted too literally.

One of the more striking points which has emerged from experimental work with DNBP is the marked influence of temperature upon the toxicity. As the temperature during and after spraying increases, the effects on plants become more severe, and the indications are that this effect of temperature is considerably greater with DNBP than it is with DNOC. The reasons for this are as yet unknown; it may be related to the greater volatility of DNBP. The practical implications are however clear—when the air temperature at the time of spraying exceeds 60–65 °F., it is advisable to reduce the amount applied in order to minimize crop damage, while at temperatures much below 55 °F., the efficiency is generally so reduced as to render spraying uneconomic.

Another aspect which requires further investigation is the effect of growing conditions both before and after spraying on the response of peas and weeds to DNBP. Such factors do not lend themselves readily to experimental study, and the only information at present available is from observations on crops in the field.

The extent to which crop damage occurs depends largely upon the hardness or softness of the growth, peas which have grown rapidly during a period of warm, moist weather being more susceptible. It is desirable, however, that the temperature should be about 60 °F. at the time of spraying, followed by a period of good growing weather so that the crop recovers rapidly and suppresses any weeds which have been stunted but not killed.

Table 2

Comparative Susceptibility of Some Annual Weeds to DNBP

Weed Species		Maximum height at which an effective kill can be obtained with a normal application of DNBP
Common Name	Scientific Name	
		inches
Very susceptible		
Charlock	*Sinapis arvensis*	4
White mustard	*Brassica alba*	4
Treacle mustard	*Erysimum cheiranthoides*	4
Hemp nettle	*Galeopsis tetrahit*	4
Moderately susceptible		
Bearbind	*Polygonum convolvulus*	3
Pennycress	*Thlaspi arvense*	3
Wild radish	*Raphanus raphanistrum*	3
Shepherd's Purse	*Capsella bursa-pastoris*	3
Not so readily killed		
Groundsel	*Senecio vulgaris*	2
Mayweeds	*Matricaria* sp.	2
Corn poppy	*Papaver rhoeas*	2
Chickweed	*Stellaria media*	1½
Fat-hen	*Chenopodium* sp.	1½
Goosefoot	*Atriplex* sp.	1½
Fairly resistant		
Cleavers	*Galium aparine*	Cotyledon stage
Annual nettle	*Urtica urens*	" "
Willow-weed	*Polygonum persicaria*	" "
Knotgrass	*Polygonum aviculare*	" "

Susceptibility differs with Variety Studies of the differences in response to herbicidal applications of different varieties of a single species are always of scientific interest and, where crop plants are concerned, of great practical importance. Preliminary experiments have shown that pea varieties do differ in their susceptibility to DNBP but there is as yet insufficient information available on which to base practical recommendations. The type of results that have been obtained may be seen in Table 3, where the yields obtained in an experiment carried out at the N.A.A.S. Experimental Husbandry Farm, Terrington St. Clement are set out. Six varieties of peas were sprayed, when the plants were approximately 4 inches high, with two amounts of DNBP in the form of ammonium salt. The varieties which are designated by letters in the table included five canning and harvesting types (A–E) and one field pea (F).

Experiments of this nature which are designed to determine the direct effect of the herbicide on the crop are much easier to interpret if the plots can be kept free from weeds. If weeds do grow, as they did in this experiment, it is difficult by measuring yield alone to distinguish between the beneficial effects of weed suppression and the harmful effects of crop damage.

Table 3

Effects of Two Rates of Application of DNBP on the Yields of Six Varieties of Peas

(Sprays applied at 100 gallons per acre)

	Yield of Threshed Peas (cwt. per acre)				Yield per cent of Control	
	Control	2 *lb.* *per acre*	5 *lb.* *per acre*	Difference between 2 and 5 lb. Dosages	2 *lb.* *per acre*	5 *lb.* *per acre*
Canning and Harvesting						
A	8.33	11.76	7.24	+4.52	141	87
B	12.01	17.54	14.30	+3.24	146	119
C	16.84	24.85	18.62	+6.23	148	111
D	24.02	34.25	30.38	+3.87	143	126
E	7.69	14.36	13.98	+0.38	187	182
Field						
F	8.83	10.04	12.84	−2.80	114	145
Sig. Dif. (P=0.05)				3.94		

The difficulty can be partly overcome by using two dosage rates, one of which will kill most of the weeds likely to be present without harming the crop, and the other which will injure the peas. A true estimate of the relative susceptibilities of the varieties can then be obtained by comparing the yields at the two treatment levels. It is seen from the last two columns of Table 3, where the yields of the DNBP-treated plots are expressed as percentages of the control yields, that the 2 lb. rate has, with all varieties, resulted in a yield increase, while the higher dosage has caused a reduction in the yield of all varieties except one.

Varietal differences in susceptibility to the herbicide are most clearly brought out by comparison of the differences in the percentage yields at the two dosage rates. The yield of Variety A dropped from 141 per cent of the control at the low rate to 87 per cent at the higher rate. This variety appeared to be growing more rapidly during the period prior to spraying and was most severely scorched by the spray. The yields of varieties B, C and D showed a smaller drop from the low to the high dosage rates, while E gave the same yield at both treatment levels. The field pea was exceptional, as it yielded more at the 5 lb. per acre rate, indicating that even at this high rate of application of the herbicide there was little crop damage.

Further work with these and other varieties is required, and an examination of the relation between morphological characters and spray damage is needed. However, at the present time, the varieties appear to fall into three broad groups. Those grown for picking green are on the whole most susceptible, canning and harvesting varieties are intermediate, and field peas are apparently the least affected by sprays of DNBP. In the trials no variety has so far been found to be so susceptible that spraying with a rate of from 1 to 2 lb. per acre has not been successful.

The Place of DNBP in Practice DNBP, although useful, is not the complete solution to the weed problem of the pea crop. To obtain a balanced picture, the cost and efficiency must be considered in relation to that of mechanical cultivation and alternative selective herbicides. When peas are grown in widely spaced rows, one or more cultivations can usually be carried out before the peas bend over and fill the spaces between the rows. The cost of these cultivations would be less than that of an application of DNBP, and many growers will no doubt prefer to continue to keep their crops clean in this way, even though some weeds are inevitably left in the rows. It is when the peas are close-drilled or when cultivation becomes impossible for other reasons, that selective herbicides are invaluable.

Other herbicides have been used, peas being more resistant than a number of annual weeds to MCPA (sodium 2-methyl-4-chlorophenoxyacetate) applied as a dust. With MCPA the risk of crop damage is greater and the range of annual weeds controlled is smaller. This dust has the advantage, however, that it will stunt the growth of many perennial species and at application rates of 2 lb. MCPA per acre is considerably cheaper than DNBP at 2 lb. per acre. If the dominant weed is charlock, a copper sulphate spray may prove effective and is the cheapest of all.

On the whole, however, both experiment and observation suggest that the most satisfactory selective herbicide for peas available at the present time is DNBP—even when the staining and poisonous properties are taken into consideration. It is difficult to lay down hard and fast rules for successful application because of the influence of growing conditions and environmental factors. But as results of further investigations become available, and as more experience is gained of its use in the field, there is every likelihood that DNBP will prove to be an increasingly valuable ancillary to the practice of pea growing.

TRAILERS

H. J. HINE

Ministry of Agriculture and Fisheries

The tractor-drawn trailer has, for the most part, superseded the horse-drawn cart and wagon. Mr. Hine here discusses the respective merits of the two- and four-wheeled types.

ONCE upon a time every farm had a man called a carter. The name came to apply to all who looked after horses, and its wide use indicates how important carting used to be ; it is no less so today, when we call it " farm transport ". Seeds and manures have to be carted to fields, produce has to be carried off, cattle food has to be distributed and milk churns have to be taken to the main road.

Wagons of a hundred years ago were extremely efficient farm implements ; all they lacked was pneumatic-tyred wheels. Within the limitation of iron tyres, the shape and size of the wheels were exactly right for the soft soil conditions of the fields, and quite good for the hard highroad, too. The

wheel bearings were of sound design, the axle-trees were solid and long lasting, and the front axle swivelled on an ingenious steerage turntable. Beautiful, almost yacht-like bodies were produced, and the curved woodwork provided scope for gaily coloured painting and artistic lettering.

Not all farmers favoured four-wheelers. Many considered that two-wheeled carts enabled the horses to do more useful work—a view that was supported by the results of dynamometer tests carried out by the Royal Agricultural Society at Bedford in 1874. Pair-horse wagons loaded with 45 cwt. of roots were compared with single-horse carts loaded with 20 cwt. of roots. The dynamometer readings showed that on a roadway, the average draught per ton of pay-load was 68.1 lb. for wagons and 51.4 lb. for carts. On arable land the wagons showed a mean draught of 295.2 lb. per ton of pay-load, and the carts 201 lb.

Two- and Four-Wheeled Trailers Compared

Trials carried out on tractor-drawn, pneumatic-tyred trailers do not confirm these results obtained with iron-tyred vehicles. Some experiments recently made by the Swedish Institute of Agricultural Engineering at Ultuna, Uppsala, found little difference in draught between two-wheeled and four-wheeled trailers on wet sugar beet fields, and on one sample of dry, loose soil, a four-wheeled trailer carrying a given load needed only 80 per cent of the pull necessary to move the same load on a two-wheeled trailer. These differences in draught do not matter so much with tractors as with horses, for except under extremely bad soil conditions, a tractor usually has sufficient power to draw a trailer with ease. The determining factor is not the draught but the convenience in handling and the safety in travelling at tractor speeds. Here the four-wheelers have some advantages. One is that they are easier to hitch to the tractor, because only the weight of the hinged drawbar has to be lifted to bring the clevis up to the height of the tractor drawbar plate. Another is that they do not pitch so much as long two-wheelers when they traverse ridge-and-furrow land.

A four-wheeled trailer can be loaded or unloaded while the tractor is away on another job, and can then be easily hitched to the tractor when it returns. Hitching a loaded two-wheeled cart-type trailer on to an ordinary tractor drawbar is an extremely difficult task for one man, unless the load is stowed in such a way that the trailer almost balances on its axle. The only way loading and unloading can be managed at all easily is to use parking legs. These should be fitted with side soles if used on soft ground, for they are apt to sink into the soil.

If, however, the trailer is being loaded while it is attached to the tractor, uneven loading can be useful in helping the grip of the tractor wheels when the soil is slippery. The further forward the load, the greater is the weight resting on the drawbar, and this presses the back of the tractor downwards so that the extra weight given to the driving wheels helps the grip. This can never be arranged with a four-wheeler, since the drawbar is freely pivoted and is not a rigid pole.

Once the trailer is attached, it has the advantage of being compact and easily reversible and a revival of support for two-wheelers has come with the development of close-coupled, two-wheeled trailers. The combination of trailer and tractor becomes virtually a six-wheeled lorry—a powerful, manoeuvrable vehicle. Unlike the trailed cart, the close-coupled trailer has its axle and wheels well to the rear, so that even when the load is evenly distributed, much of the weight is taken on the back wheels of the tractor

and therefore is added to its back axle weight. Trailers of this kind, made for use with tractors having hydraulically-operated lifting arms, can be automatically hitched and raised off the ground even when they are already loaded.

Four-wheeled trailers are more complicated to build than the two-wheeled. The front wheels have to be made steerable. This is done either by mounting the wheels on pivoting stub axles, or by using a straight-through axle swivelling on a turntable. If a sharp lock to provide a small turning circle is required, the body of the trailer has to be built rather high, and this is a considerable disadvantage. Low loading is a useful property, especially when close, heavy, green material for silage is being handled.

Even with two-wheelers, the platform cannot be built right down on to the axle-tree if it is desired to have a reasonably large body and yet keep the vehicle within the legal width for use on the high road. This limit is 7 feet 6 inches, and when the floor of the trailer is built between the wheels, only about 5 feet 6 inches is available for platform width. If the platform is to be above the tyres and the trailer is to have a reasonably low-loading line, wheels of small diameter must be used, but only very little clearance need be left between the top of the wheel and the underside of the platform. The axles of four-wheelers, as well as of two-wheelers, are usually neither sprung nor jointed, and therefore the clearance is not reduced when the vehicle is loaded or passes over uneven ground. Enough clearance to avoid clogging by mud is all that is necessary.

Box-covers for the wheels, built into the floor of the trailer, make a lower loading line possible in a two-wheeler, but the obstructions sometimes prevent shooting out the load completely by tipping, and even interfere with unloading by shovel.

Tipping Trailers Tipping trailers are particularly useful for roots and farmyard manure, and for discharging combine-harvested grain into the receiving pits of grain-drying installations. Most tippers are two-wheeled, although four-wheeled tipping trailers are made. Some trailers are made to tip to the side as well as to the rear—a great convenience in grain handling.

Screw-operated tipping devices are common, but there is an increasing use of hydraulic mechanism to operate the tip. An extension pipe and flexible hose fitted to the hydraulic system of the tractor, conduct the fluid pressure to work the tipping mechanism of the trailer. Even with trailers towed by tractors not having hydraulic power, the hydraulic method of tipping can be used. A hand pump mounted on the drawbar supplies the oil pressure needed to work the lifting cylinder.

Many kinds of body are available for trailers. Some are merely a platform, with perhaps harvest ladders at each end ; others have deep sides, close fitting enough to hold grain. When the particular needs of a farm cannot be met by a ready-made trailer, a chassis can be purchased, and a platform or body can be built on to it on the farm. If several different bodies are needed for short periods during the year, a trailer which can be changed from one type to another by use of conversion sets may prove economical.

THE STORAGE OF LATE DESSERT APPLES

FRANKLIN KIDD, C.B.E., D.Sc., F.R.S.
and
CYRIL WEST, O.B.E., D.Sc., F.L.S.

Department of Scientific and Industrial Research

How well do late dessert apples stand up to air storage? A three-year investigation at Ditton, briefly described in this article, affords some useful information.

AN investigation has been carried out at the Ditton Laboratory of the Food Investigation Organization of the Department of Scientific and Industrial Research during the three years 1948-50, into the behaviour in air storage of twenty varieties of dessert apples. From the results obtained there seems little doubt that there is no technical difficulty in the commercial storage in excellent condition up to March or April of several varieties of home-grown dessert apples. The detailed results will be published in due course*, but the following gives a brief account of the trials. The varieties tested were as follows :

English Varieties	Grown at
Barnack Beauty	East Malling, Kent
Belle de Boskoop	,, ,, ,,
Court Pendu Plat	,, ,, ,,
Crane's Seedling (No. 857)	Writtle, Essex
D'Arcy Spice	Goldhanger, Essex
Granny Smith	East Malling, Kent
Heusgen's Gold Reinette	,, ,, ,,
John Standish	Near Maidstone, Kent
Jonathan	East Malling, Kent
Laxton's Superb	,, ,, ,,
Orleans Reinette	,, ,, ,,
Tydeman's Late Orange	,, ,, ,,
Tydeman's Seedling (a cross between Stirling Castle and Brownlee's Russet)	,, ,, ,,
Wagener	,, ,, ,,
Winston (formerly Winter King)	Faversham, Kent
Continental Varieties	
Champagner Reinette	Switzerland
Glockenapfel	,,
Gronswalde Klumpke	Holland
Lombard's Calville	,,
Present van England	,,

Each variety was gathered on the date recommended by the grower, except in the 1949-50 season, when a second gathering of the five most promising varieties was made about a month later. The fruit was stored in air at two temperatures, 37°F. (2.8°C.) and 31.5°F. (–0.3°C.). The higher temperature was chosen because it is probably the optimum for most English dessert varieties where flavour is important ; the lower was used to test the susceptibility of the fruit to low-temperature injury.

Gas storage trials were not undertaken because the necessary facilities were not available at the time. The trials in air are being continued, and it is hoped that the best conditions for gas storage of the more promising varieties will shortly be determined.

* The Storage Qualities of Late Dessert Varieties of Apples. F. KIDD and C. WEST. *Dep. sci. industr. Res., Lond., Food Investig. Tech. Paper* (in preparation).

Storage Results The home-grown varieties which appeared most promising as regards their behaviour in storage, were Barnack Beauty, *Belle de Boskoop*, D'Arcy Spice, Tydeman's Late Orange and Winston. These five varieties and the Swiss variety, *Glockenapfel*, were held at 37°F. in good condition with little wastage until March or April, when their dessert quality was as good as, if not better than, that of most imported varieties arriving in this country at that time of the year.

Barnack Beauty and *Belle de Boskoop* are susceptible to low-temperature breakdown and therefore should not be stored at as low a temperature as 31.5°F. At this temperature the life of the other four varieties was almost the same as at 37°F. ; in fact, little advantage was gained by storing these varieties at the lower temperature.

Only a slight loss of ascorbic acid (vitamin C) occurred during storage for three to four months at either temperature. *Belle de Boskoop* has an outstandingly high content of vitamin C, as compared with the other five varieties. This may be related to the fact that it is a triploid variety. It is interesting to recall that the Bramley's Seedling, which is outstanding among culinary varieties in respect of its content of vitamin C, is also a triploid variety.

Effect of Date of Gathering It is generally agreed that apples increase in size and weight and improve in quality the longer they remain on the tree, but growers in this country usually consider it advisable to gather their late varieties intended for long storage before they show much sign of ripening, i.e., in a pre-climacteric condition. This is the correct procedure for culinary apples intended for cold storage or refrigerated gas storage, but in the case of late dessert varieties, for which appearance and flavour are of prime importance, better results may be obtained by leaving the fruit on the tree up to a month longer than appears to be the present practice. From the consumer's point of view, every reasonable step should be taken to ensure the best possible quality in dessert apples, and from the point of view of the grower, the high quality of the home-grown product is one of his main assets in meeting competition from abroad. The 1949-50 experiments provide interesting data which may help the grower to reach a decision on the best time to gather late dessert apples.

In these experiments the apples of the later gathering were larger, heavier and much superior in dessert quality to those gathered at the usual time. The gain in weight during the extra month on the tree varied from 7 per cent (for D'Arcy Spice) to 28 per cent (for Tydeman's Late Orange). The red area of the surface of the fruit, in the case of each of the three coloured varieties, had more than doubled, as is shown on page 278.

With the other two varieties, there was no obvious improvement in the appearance of the later-gathered samples, but this is not surprising in view of the fact that D'Arcy Spice is not a coloured variety and that in this particular season the *Belle de Boskoop* apples had no colour. No significant difference in content of ascorbic acid (vitamin C) was observed as between the two gatherings.

The storage tests at 37°F. showed that in the case of the five varieties Barnack Beauty, *Belle de Boskoop*, D'Arcy Spice, Tydeman's Late Orange and Winston, a difference of about a month in the maturity of the fruit

when gathered did not materially affect the date at which the apples had to be marketed, which was from March to early April. At this date the members of the tasting panel were unanimous in their opinion that the later-gathered fruit had the better dessert quality.

Variety	Percentage of Surface for Fruit showing Red Colour	
	Normal Gathering	*Late Gathering*
Barnack Beauty	18	48
Tydeman's Late Orange	30	70
Winston	25	70
Average	24	63

The average figures for weight loss during storage, determined on the same date for both gatherings, were 5.5 and 2.7 per cent at 37°F. and 31.5°F. respectively for the normal gatherings, compared with 4.1 and 2.5 per cent for the later gatherings. Taking into consideration the longer time the earlier gathered fruit had been in store, there appears to be little, if any, difference in the rate of water loss as between the two gatherings. In this connection it should be borne in mind that even the earlier gathered apples were mature when picked.

Summary From an investigation into the behaviour in storage in air at 37°F. and at 31.5°F. of twenty late dessert varieties of apple, including several Continental varieties, it was established that the most promising home-grown varieties were Barnack Beauty, *Belle de Boskoop*, D'Arcy Spice, Tydeman's Late Orange and Winston. These five varieties and the Swiss variety, *Glockenapfel*, have been kept at 37°F. in good dessert condition with little wastage until March or April, and, on the basis of their behaviour in storage, can be recommended.

D'Arcy Spice, Tydeman's Late Orange, Winston and *Glockenapfel* kept well at 31.5°F. until March or April, but the advantage gained by using the lower temperature for these varieties was not great. Barnack Beauty and *Belle de Boskoop* were susceptible to breakdown at this temperature.

In the 1949-50 season two gatherings were made of the five home-grown varieties, the first at the normal time, the second about four weeks later. In the case of the fruit stored at 37°F. the difference in the date of gathering had no significant effect upon the date at which the apples were ready for marketing.

An appreciable increase in size and weight and a marked improvement in quality (appearance and flavour) were shown by the fruit of the later gathering. The date of gathering had no significant effect upon the ascorbic acid (vitamin C) content of the fruit.

It should, however, be mentioned that late gathering runs the risk of damage by birds and of loss by windfalls during the severe gales often experienced during the late autumn.

Combine Harvesting

Sacked grain being loaded into a trailer

and below

A baling machine dealing with the straw

Photos: *Ruth Rogers*

CARNATIONS UNDER GLASS (See pp. 284-8)

The second summer's crop

Photos: *J. Hardy*

Blooms placed in deep water after cutting

HARVESTING CORN WITH COMBINES

COSTS AND EXPERIENCES ON FIFTEEN YORKSHIRE FARMS

I. G. SIMPSON, B.Sc. (Agric.)
Department of Agriculture, Leeds University

The buying of a combine harvester and ancillary equipment involves a heavy capital outlay. Hence the economics of the job, related to any particular farm, need to be carefully considered.

TWO of the main reasons why farmers buy combines are to cut their costs and to reduce the demand for labour at harvest time. On some farms the second reason may be more important than the first. This is particularly so on, say, chalkland farms, where a relatively high proportion of the arable acreage is under a cereal. On these farms casual harvest labour may be difficult to obtain, or a reduction of the peak demand for labour during harvest might make it possible to run the farm with a smaller permanent staff. Do the lower costs and less labour made possible by the combine justify the large amount of capital which must be invested in the purchase of the machine and its ancillary equipment? This is a question which can be answered only with a knowledge of conditions on the individual farm.

Investigations during 1949 and 1950 into the cost of harvesting corn with a combine on fifteen Yorkshire farms elicited some useful information regarding both the costs and methods on these farms which may be useful to other farmers who have bought combines recently. When comparing the cost of harvesting by combine with harvesting by the other methods, it is necessary to know not only the cost of combining, but also the cost of other operations occurring during the harvest, e.g., leading grain from the fields to the buildings, conditioning the grain and clearing and stacking straw.

A major difficulty in calculating the cost of operating expensive machines such as combines and pick-up balers is the large proportion of the costs attributable to depreciation. Even on a fairly modest reckoning, depreciation accounts for over half the cost of operating combines and a third that of pick-up balers. The actual depreciation cannot be calculated until the length of life of the machine and its scrap value is known, and this obviously is impossible to know in advance. Mainly because of this difficulty, the following account of costs of operating combines and pick-up balers refers only to those costs which are fairly easily assessed and which, for the most part, vary directly with the amount of work done by the machines.

Operation Costs The average cost (excluding depreciation) of operating seventeen combines in 1950 was 11s. 1d. per acre. This figure is the average of the costs of a number of different types of combine, including fourteen self-propelled combines and three smaller tractor-drawn machines. All the combines delivered the grain into sacks. Although it has not been possible to make a satisfactory comparison of the costs of operating different types of combine, the variations do not appear to be great.

Labour accounted for about half the cost of operating the self-propelled combines, petrol for just under a third, repairs for about fifteen per cent, and small items such as grease, oil, tax and insurance for the remainder.

The costs of operating the tractor-hauled machines were made up of 43 per cent on labour, 33 on the tractor hauling the combine, 17 on fuel for the combine engine, 5 on repairs and 2 per cent on oil and grease.

The cost of labour usually includes the cost of two operators, one driving the combine or tractor and the other bagging off. Another man might help with the bagging if weighing were done on the combine. Allowance has been made for time spent in routine maintenance work (such as greasing), in field repairs and in moving from field to field.

The average area harvested per combine is perhaps most satisfactorily expressed in acres harvested per foot of cutter-bar width. The average acreage harvested per foot cut was 14.4. This may seem rather low, yet it should be remembered that there may be advantages in using the combine to harvest an acreage considerably below its full capacity. By so doing it would be easier to use the combine only when the weather is most favourable and, as a result, less corn might require drying. Against this, there is obviously an advantage in spreading the fixed costs over as large an acreage as possible. Two of the combines included in the calculations dealt with only just over 5 acres of corn per foot of cut ; such a small use could hardly be economic. Three of the combines harvested over 20 acres per foot of cut, and in 1949 one combine dealt with 32 acres per foot of cut. Where a fairly large acreage was harvested, this was often due to contract work being undertaken for neighbouring farmers.

On average the self-propelled combines covered by the 1950 investigation harvested just under 1.2 acres of corn per hour, threshing out about 24 cwt. of grain during this time. The smaller self-propelled machines with a 8½-foot cut were only slightly slower than those with a 12-foot cut. In 1949 the small tractor-drawn machines worked almost as fast as the self-propelled combines. In 1950 they worked at a slower rate per acre, but this was due in part to the heavy crops they had to deal with.

The combines handled a wide range of crops, including barley, wheat, oats, rye, beans, peas and clover seed. With the exception of peas, all these crops were combined direct ; peas were first reaped by a grass mower or pea cutter and then turned before being picked up by the combine.

One-Man Pick-up Balers The usual method of dealing with straw on the farms investigated was by baling with a one-man pick-up baler. Cattle were kept on all these farms and it was therefore important to recover the straw in good condition for fodder and litter. Records were obtained of the cost of operating twelve one-man pick-up balers in 1950. Seven of these were ram balers driven by an independent engine. The remaining five were of varying types, but all were driven from the tractor power-take-off. The average quantity baled consisted of hay from 96 acres and straw from 152. The acreage dealt with by individual machines varied from 82 to 514 acres. Some idea of the capabilities of the larger machines can be judged from the fact that in 1949 one baler was used for 690 acres.

The following notes on cost and performance refer only to the averages of the seven ram balers with independent engines. The average cost of operating these seven balers was 22s. 9d. per hour, 11s. per acre and 14s. per ton of straw baled. Twine accounted for 56 per cent of this cost, labour 13, the tractor hauling the baler 18, petrol for the baler engine 7, and repairs 5 per cent. The rapid rise in the cost of twine means that it is likely to account for about 65 per cent of the total cost this year.

On average, approximately 32 cwt. of straw was baled an hour, at a rate covering the produce from 2.1 acres. For hay the throughput was 54 cwt. per hour, representing 1.6 acres ; this rate was slower but owing to the heavier weight per acre, throughput was greater.

It is perhaps worth noting that these balers cleared an acre of straw in little over half the time necessary for combining. This suggests that a baler of this type can handle the straw left by two combines. Straw was generally picked up from the rows left by the combine but on some farms it was first raked into larger windrows. On five farms this cost, on average, 2s. 2d. per acre.

Other Operations All the combines concerned were of the bagger type. Usually a gang of three to five men, working with a tractor and trailer or lorry, were used for picking up the bags and taking them to the farm. The same gang was often used for leading and stacking straw bales. The average cost of removing the grain amounted to 5s. 3d. per acre, that of leading and stacking straw bales, 7s. 1d. per acre. A small item was the cost of hiring grain sacks, which, on nine farms, averaged 2s. 4d. per acre.

Many farmers who have bought combines have been anxious to avoid the additional costs of buying dressers and driers. This tendency was apparent amongst the fifteen farmers who co-operated in the investigation. Two of the farmers owned driers, and six had dressers but no drier. In 1949 all the grain was sold as it came from the combine on eight out of the fifteen farms, but only two farmers were able to sell their grain in this condition in 1950. Besides the two farmers who had driers, six farmers had about a third of their grain dried by contract at prices varying from 30s. to 42s. 6d. per ton. The cost of drying on the farm was not ascertained, but on six farms the average cost of dressing was 9s. per ton.

The following table gives the average costs and labour requirements of those operations which were typical of corn harvesting on the fifteen Yorkshire farms :

Operation	Number of Farms in Average	Cost per Acre	Man-Hours per Acre
	£	£ s. d.	
Combining	15	11 1	2.2
Hauling grain seeds	15	5 3	1.3
Dressing grain	6	9 7	2.0
Pick-up baling	12	11 3	0.6
Hauling and stacking straw bales	12	7 1	1.9
Sack hire	9	2 4	—
Total		**2 6 7**	**8.0**

The total cost of £2 6s. 7d. per acre does not include any allowance for depreciation on the combines and balers. If depreciation is calculated on the original purchase price of these machines, the cost given is misleading when contrasted with other methods of harvesting. This is because prices have risen considerably since many of the machines were purchased. It would therefore be more satisfactory to charge depreciation on the basis of what these machines would have cost in 1950. As explained earlier, the rate of depreciation has of necessity to be fixed on an arbitrary basis. It is probably not unreasonable to assume that these machines will have a working life of ten years. Machines used on a smaller acreage might last longer, but there is a risk of their losing value through becoming obsolete.

If depreciation is calculated on 10 per cent of the cost of the machines

at 1950 prices, it is equivalent to an addition of 20s. 10d. per acre combined and 5s. 8d. per acre of straw baled, on the average costs given in the table—a total increase of 26s. 6d. per acre. If this is added to the total cost of the harvesting operations, the figure, including depreciation, becomes £3 13s. per acre. If the grain were dried at a cost equivalent to 35s. per acre instead of being dressed, the total harvesting cost would be £4 18s. 6d. per acre.

To some extent the above costs do not represent the *full* costs involved in harvesting by this method. For instance, if grain is to be sold at the top prices or fed to the farm stock, storage must be provided. One of the reasons why some of the Yorkshire farmers harvested their oats by binder rather than by combine was to avoid the cost of storing loose grain.

Interest might be charged on the capital invested in the harvesting machinery. The purchase of a self-propelled combine, power-take-off baler, power dresser and storage bins for 60 tons of grain represents an investment of about £2,500 at today's prices. If this equipment is bought to handle, say, 120 acres of cereals, the interest charge amounts to about 10s. per acre per year.

How do these costs compare with those for harvesting with a binder and threshing from the stack ? An investigation into the cost of growing wheat on Yorkshire farms (1) in 1950 showed that the average cost of harvesting with a binder was £2 19s. 8d., excluding threshing costs which are not yet available. A report on barley growing in Durham and Northumberland in 1949 (2) gives the cost of threshing as £1 15s. 10d. per acre (excluding overhead and miscellaneous costs). If the two figures are added together, the total cost of harvesting becomes £4 15s. 6d. per acre.

It would be unwise to make a close comparison of this cost with that given for harvesting with a combine, but it is apparent that the difference between the cost of the two methods is not great.

A comparison of labour requirements is more favourable to the combine method. The Yorkshire investigation into wheat costs gives a figure of 13.8 man-hours per acre required for harvesting with a binder up to the time of threshing, and the report on barley growing shows a requirement of 10 man-hours for threshing, a total of 23.8 man-hours per acre. Against this, only 8 man-hours per acre were required using the combine. Yet only about 6 man-hours out of the total saving of nearly sixteen actually occurred at harvest time, the rest being saved by the elimination of threshing. It should also be noted that a fairly large gang of men was employed even where a combine was used. To handle a bagger type combine, pick-up baler and power dresser, and to do the necessary carting, requires a team of at least seven men.

Thus it appears that although the newer methods have reduced the labour requirements of the harvest, the cost of the labour saved has largely been offset by depreciation and interest charges. It should, however, be remembered that these conclusions are based on the records of harvesting on a very small number of farms and can be relevant only where similar methods of mechanizing the corn harvest are considered. On other farms, using similar machines, it may have been possible to secure greater economies.

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A BRITISH STANDARD FOR DUTCH LIGHTS

C. E. PEARSON

Ministry of Agriculture and Fisheries

THE publication of a British Standard for timber Dutch lights* marks a significant stage in the development of the horticultural frame. It comes at a time when Dutch light cultivation has already aroused a new interest among commercial growers, promising to be a major development suited to the economic conditions likely to rule in the immediate future.

This move towards the standardization of commonly used horticultural equipment may seem to some to have been very long in the making. There were hot-beds in Roman days—pits filled with fermenting manure and covered with sheets of talc—and later on, came many ingenious protective devices—wooden frames on wheels that could be drawn into buildings on frosty nights and various forms of straw mattresses or linen sheets for covering seedbeds. But progress was slow, for after the great Empire fell and the Dark Ages held sway, knowledge and experience of horticulture, as of most other things, were either lost or failed to spread. No significant development took place until Elizabethan times, when glass first came into commercial use and led to the orangery and the bell-jar. From the orangery, several different forms were developed, and during the eighteenth century glasshouses of various sizes and designs, all having heavy timbers and small panes of glass, were to be found on most of the large estates and many market gardens. The commonest were the lean-to types, and from the smallest of these came the more modern English frame with brick or timber walls. In some cases, however, the lights were used on earthen walls, and in others they merely gave a top protection to the plants beneath by being placed on four wooden supports, and may therefore be regarded as the prototypes of the lights and larger-type cloches of today. Heating by flues and, at a later date, by hot water, was also introduced, but when, about a hundred years ago, sheet glass was first manufactured in four-foot lengths, the chance of reducing the number of small panes in the light was inexplicably ignored. It was left to the great gardeners of the Netherlands to use one sheet only and so give the world the Dutch light. During the last fifty years there has been a general move towards uniformity of size and manufacture, but no serious attempt at true standardization had been made in Britain until a little over two years ago, when the National Farmers' Union asked the British Standards Institution to consider the preparation of a British standard for timber Dutch lights.

One Standard Size Only The specification is the work of a sub-committee representative of all the interests concerned. It prescribes the materials and the methods of construction to be used, and lays down overall dimensions for one standard size (4 ft. 11 in. × 2 ft. 6¾ in.). For although the Committee recognized the fact that Dutch lights at present in use do not all conform to this size, they were unanimous in their decision that the time had come when one standard size only should be adopted. At the same time a reasonable flexibility is allowed in the type of construction—two reversible types, one with nailed joints and one with combed joints, and a non-reversible type with combed joints. In this way growers have a

**British Standard* 1612–1950. *Timber Dutch Lights.* With amendment PD 1165. March, 1951. (British Standards Institution, London.)

reasonably wide choice ; yet since all types are standard, any one will cover the same area as another, whether used on the flat or on a structure, and all may be used together.

Three kinds of timber are allowed (redwood, western red cedar or Douglas fir) but the quality and finish of all is defined. The type and method of jointing, the adhesive and preservative (where required) and the kinds of glass, nails and screws are all laid down, but purchasers are left free to choose the form in which delivery is to be made. The nailed type of frame may be delivered assembled or ready for assembly, and all types may be delivered glazed or unglazed with either clear or R quality glass.

What form Dutch lights and structures will eventually take and what materials may become most popular, cannot today be easily visualized. Perhaps, as with most other horticultural equipment, a final, unalterable stage will never be reached. But whether the future favours fixed or movable structures, and whether these are made of metal or timber, with or without equipment for heating and irrigation, the opportunity to achieve all the benefits of standardization is already at hand and may well assist the further development of Dutch light cultivation, which seems likely to become increasingly important in future production.

CARNATIONS UNDER GLASS

A. D. HARRISON, N.D.H.

National Agricultural Advisory Service, South-Eastern Province

Although the growing of carnations under glass was substantially reduced during the war years, production is now almost back to normal. Mr. Harrison's article explains the methods employed to produce what is one of the most popular of English flowers.

THE perpetual flowering carnation is one of the most important flower crops grown under glass. As the name implies, flowers are produced throughout the year, and when this point is considered against the comparatively short season of some other flower crops, it is probable that in the course of a year, more money is spent on carnations than on any other flower.

This type of carnation was first grown commercially under glass in this country in 1909, and the crop expanded gradually until, in 1939, a total of 80 acres of glasshouse area were occupied by the crop. The need for food crops during the war reduced this acreage substantially, but since all restrictions on the cropping of glasshouses have been removed, most of the growers are back to their pre-war acreage and some newcomers have been added to the list. Further expansion will probably take place at the expense of other crops rather than in completely new glasshouses, as the present cost of suitable houses adds a heavy capital charge to the cost of production.

A Crop for the Specialist The carnation is a crop for the specialist grower, and in such hands reasonable economic returns have been obtained. No doubt there is a limit to the expansion which can take place since the crop is expensive to produce, and over-production could

bring the market price to an uneconomic level. Be that as it may, there is nothing surer than that any attempt to grow this crop without giving it the care and attention which it demands, will most certainly result in failure.

The type of house most frequently used for growing carnations is large and airy. Thirty feet or thereabouts is a usual width and, with eaves at six feet, the whole of the area is available for cropping and paths. Usually, blocks of such houses are erected without dividing walls as they are less expensive to build than single houses. The lengths of houses vary considerably, but a house of not more than 250 feet is more convenient for many of the operations connected with the management of the crop. Carnations can be grown in houses which, compared with the one described above, appear totally unsuitable, and as an example of this it may be mentioned that Mr. C. J. Horwood of Basingstoke Joint Nurseries is producing blooms of excellent quality in cucumber houses. However, this is a case where knowledge of the crop and its management is of the highest order, and less skilled growers might easily come to grief in attempting to follow this practice.

The carnation is a "permanent" crop in that it will remain where planted for two or three years. It is important to provide suitable soil, and as even in new houses such a soil is seldom found *in situ*, special compost is prepared. The type of compost used may vary, but important considerations are that the loam employed should be of medium texture, the organic matter fairly high, and the mixture should be sufficiently open to permit the free movement of water. As the calcium requirement of the carnation plant is high, it is likely that lime will have to be added.

It is interesting to note that the carnation is one of the crops which is completely satisfactory commercially when grown in sand or aggregate to which the necessary plant nutrients are supplied by sub-irrigation. A number of established growers have now transferred entirely to soilless culture and appear to be satisfied that the quantity and quality of flowers produced in sand is at least equal to that of flowers produced in the orthodox manner. Advantages claimed in other respects include ease of management, especially in regard to watering, absence of weeds, more exact control over the supply of plant nutrients, and the saving of much time and labour in preparation of soil compost. Initial outlay on sub-irrigation systems is greater and a more exact management and knowledge of the plant's requirements is essential. It seems probable that the acreage of carnations grown in this way will increase.

Maintaining Healthy Plants One of the greatest problems in cultivating carnations is to keep them free from serious diseases such as Wilt (*Verticillium cinerescens*) and Fusarium Wilt (*Fusarium dianthii*). While it is probable that a new site is free from such diseases, it is certain that they are present in the soil on all old-fashioned nurseries. For this reason it has been found necessary to adopt a system of growing the plants in beds. This procedure ensures that the roots of the plants are not in contact with contaminated soil and that old soil can be completely removed and the beds thoroughly cleansed between crops. Frequently walls and floor of beds are made of concrete, which is ideal for the purpose ; less satisfactory types have bricks or land drains to form the base, and boards are used for the sides. Four feet is a usual width and depth of soil in the beds is approximately 7 inches. The beds are separated by paths about 20 inches wide, which allows five 4 feet beds and six paths in a house 30 feet wide.

While it is extremely difficult to prevent disease becoming established on a nursery, much can be done to prevent its reaching serious proportions by

taking every precaution to propagate only from healthy plants. The practice of growing selected stock plants in pots solely for the purpose of providing cuttings has much to commend it. Such plants grown in the isolation provided by a pot can be rogued as necessary, and with the elimination of plants showing signs of disease or weakness of any kind, a stock healthy, vigorous, and true to character, is built up. This system, as compared with taking cuttings from flowering plants in beds, obviously entails greater cost and trouble, but it is found to be fully justified by increased crops of better quality flowers.

Cuttings 4–5 inches long are prepared by removing three pairs of lower leaves and cutting cleanly across the stem immediately below a joint. The propagating season extends from October to February, and clean sharp sand is the best medium. It is interesting to note that although the cuttings are only in the sand for about five weeks, fresh sand must be used for successive batches of cuttings. If the same sand is used a second time many cuttings will fail to develop roots. The majority of growers root the cuttings on benches, though some favour the more laborious method of rooting them in 5-inch pots. In either case, bottom heat provided by pipes under the propagating bench, and an air temperatute of 55°F. are desirable for quick rooting.

Cuttings must not remain in the sand longer than necessary, otherwise they will be weakened. They are first potted into 2½-inch pots, using a John Innes compost, the formula for which is well known. After the plants are established in the pots, the point of the growth is removed to lay the foundation of a branching habit which will ensure the maximum number of flowering shoots in a plant of given height. This work of "stopping" is continued after secondary growths are of suitable length, the work being carried out over a period to ensure as far as possible that a plant will produce a continuous supply of flowers, rather than a flush followed by a blank interval.

Planting takes place as soon as plants are well-rooted in 2½-inch pots—usually February or March. The distance allowed between plants and rows may vary within considerable limits according to the opinions of the growers. For example, some plant only 45,000 plants per acre, while, in another instance where plants were being grown in sand with sub-irrigation, 72,000 had been planted. It is argued that closer planting will reduce the number of first-quality blooms, and it seems probable that, as frequently proves to be the case, a middle course of 55,000 – 60,000 plants per acre will prove most economical.

Looking after the Crop Supporting the plants throughout their life is no easy task, but the standard system employed is neat and effective. It consists of a row of wires, the number varying according to the number of rows of plants in the bed, stretched tightly on a cross-bar of metal tubing which, in turn, is anchored by straining posts at either end of the bed. These wires are then crossed with thin string so that each plant is contained in a square. The first tier of wire and string is arranged at 6 inches above ground level, and additional tiers are arranged at 6-inch intervals as growth proceeds until, when the crop reaches maturity, the supports may be in position up to a height of 5 feet or more. Intermediate posts and cross pieces are fixed at intervals of 14 feet throughout the length of the bed to give added strength.

Cultural operations during the life of the crop, apart from harvesting, include watering, ventilating, feeding and disbudding. Need for care in

watering must be emphasized ; even in an open-textured compost damage can be done by over-watering, especially during the winter months. On the other hand, extreme dryness of the soil occurring during the summer is harmful. As in the growing of all plants, it is experience alone which enables the requirements of the crop under all conditions to be assessed with accuracy.

The carnation does not require warm greenhouse conditions, and the generous supply of ventilators provided in a carnation house helps to maintain an even temperature during the summer. Even in winter some ventilation is given, unless outside conditions are very severe ; and a night temperature of 45°F. is quite sufficient to keep plants growing and flowering. Temperatures above this figure are likely to soften the growth and poor-quality flowers will result.

The topdressing with fertilizers of plants set out in March begins in mid-June and is continued at fortnightly intervals until October. A suitable mixture can be made up from 7 parts dried blood, 3 parts superphosphate and 1 part sulphate of potash, and is applied at the rate of 2 oz. per sq. yard. Both the interval between applications and the quantity given should be varied according to the needs of the plant as evidenced by its growth. For instance, nitrogen in excess of requirements will cause soft growth of plants, especially in the autumn and winter months.

Disbudding—a necessary operation—consists of the removal of all axillary buds while they are still small, thus ensuring the maximum development of the terminal bud and of the flower to follow. This work goes on continually after flowering stems are first produced.

The carnation is a neat plant and its culture lends itself to tidiness. In most establishments the standard maintained is of a very high order and every care is taken to collect and destroy all plant debris, an essential factor in the prevention of disease, apart from its effect on neatness.

While flowers are produced throughout the winter, the plants are, to some extent, rested. The second year starts in February, when the surface of the beds is scarified lightly ; feeding begins at this time and is continued, as previously indicated, at approximately fortnightly intervals until the following October. An application of ground limestone or chalk is given in the early spring.

The normal practice used to be to keep a crop going for three years, and sometimes longer, but the present trend is to clear the crop after two years. In the third year the flowers produced are smaller and in consequence the number suitable for top-grade packs is much reduced. It is also in the third year that disease can cause heavy casualties among plants, with consequent reduction in yield.

When a crop is cleared, the utmost care must be taken to ensure that complete hygiene is observed and thus minimize the risk of carrying forward troublesome pests or diseases. Destruction of all plants by burning, washing down houses with 2 per cent formaldehyde, the removal of old soil and the introduction of new, are some of the measures recommended.

The major pests of carnations include aphids, red spider mite, thrips and tortrix moth. The introduction of new insecticides has been of the greatest value to carnation growers, and with the aid of such materials as HETP, Azobenzene, and DDT, the pests mentioned need never become a menace. Some of the new insecticides (i.e., the dinitro and organo-phosphorus compounds) are, however, toxic to man and precautions must be taken

when using them. Such precautions include the wearing of protective clothing, the provision of adequate washing facilities and the restriction of working periods.*

New Varieties New varieties are obtained from seed or from bud-sports. As there are specialists in seed-raising in this country, the U.S.A., Holland and elsewhere, a steady flow of new varieties is forthcoming, but only a small number of them find favour with commercial growers. A variety to meet the requirements of the grower must be of a type that is vigorous and prolific, producing a fair proportion of good flowers during the winter months. Fancy colours are not in great demand, the market preferring pink, scarlet, white, and crimson shades. Some of the newer introductions from America produce very large blooms on fine, strong stems and, as individual blooms, leave nothing to be desired. However, the number of blooms produced per plant during a given period is very much less than the number of blooms produced by some of our standard market varieties, and under present conditions it is doubtful if the extra price obtained for the larger blooms will compensate for their lack of numbers.

The perpetual flowering carnation is pleasing to grow and has been reasonably profitable. Owing to the fact that it is a crop for the specialist and that initial capital outlay can be heavy, it is unlikely that any sudden or great expansion of the industry will occur. Many inquiries from interested growers are received, however, and to meet the need for detailed information on the cultivation of the crop, the Ministry has in preparation a new bulletin entitled *Carnations under Glass*. The bulletin describes in detail a recommended method for producing a commercial crop of carnations, and gives guidance on all matters which might arise between taking cuttings and clearing the exhausted crop.

* Advisory Leaflet 374, *Precautions in the use of Insecticides, Fungicides and Weed-killers*, gives full details of the precautions which should be observed. Free on application to the Ministry (Publications), 36-38 Chester Terrace, Regent's Park, London, N.W.1.

Correction

"The New Forest Pastoral Development Scheme"

August, 1951, issue : page 229, line 3.

Read : "... with heather as the major plant population."

Page 233, para. 5, line 1.

Read : "The Verderers may from time to time on a presentment made to them by the Minister..."

RED FESCUE S.59 FOR TURF

I. G. LEWIS

Originally bred chiefly for the improvement of sheep pastures, pedigree red fescue S.59 is in good demand for the making of high-quality turf for sports grounds and lawns. But the seed must have a very high standard of purity.

EXPERIENCE with pedigree red fescue S.59 during recent years suggests that this grass has a great future in the establishment of hard-wearing turf for lawns and sports grounds on all kinds of soils. In 1950 nearly 500 acres of this fescue were harvested for seed. But this acreage is capable of very considerable expansion, since a large quantity of fescue seed is required annually for turf production in this country. The present time is not the most suitable to effect such expansion, but home seed-growers may like to note the possibilities and prospects for this grass.

Those who have used S.59 for turf-making value it for several reasons. Its capacity for tiller production is extremely high, and a single plant will cover several square inches of ground in a relatively short time. This vigour of growth is of outstanding importance to groundsmen and greenkeepers, who find that the use of this pedigree strain enables them to cut the seeding rate drastically. Nowadays, instead of sowing at 3 cwt. or more per acre—the normal rate for sports grounds—excellent turf can be secured by seeding rates of 60–80 lb. per acre. Not only is such turf far stronger, but the cost of sowing is, of course, considerably less. The additional advantages of a deep green colour maintained throughout winter and the capacity of the grass for developing short runners underground, are much appreciated by those responsible for lawn and turf production. But a small amount of impurity in the seed is sufficient to spoil the effect ; and this is precisely what is happening.

Pure Seed Essential At the present time, users of S.59 for turf purposes are finding numerous clumps of perennial ryegrass, and sometimes Yorkshire fog, occurring in the new turf. These coarse-textured grasses are in marked contrast to the fine leaves of the fescue, and it requires little imagination to appreciate that the general effect is most unsightly and very discouraging. The occurrence of these clumps distributed throughout turf produced on well-prepared and clean seedbeds strongly suggests impure seed, and indeed, while stocks completely free from coarse grasses, or with only a trace, can be obtained, purity reports on S.59 have shown that many of the stocks of this strain contain upwards of 0.3 per cent of coarse grasses.

It may be argued that this relatively small percentage of impurity is of little consequence and of no practical importance to the farmer-grower. But this is not so. Bearing in mind the high rate of sowing necessary (even the reduced rates are very high compared with those used in farming), the low percentage of impurity already mentioned is of considerable significance. Thus S.59 fescue sown at 1 oz. per sq. yard—half the rate normally adopted for fine lawn production—and containing only 0.2 per cent of perennial ryegrass as an impurity, is liable to introduce 28 plants of ryegrass per sq. yard. There may, of course, be casualties among the ryegrasses introduced in this way, but the chances are that most, if not all, the ryegrass seeds will germinate and become established, growing far more quickly than the fescue

and smothering the latter's fine foliage with coarse, tall-growing herbage. The result is a ruined lawn or golf green. Even in an extensive area such as a sports ground, the distribution of ryegrass or Yorkshire fog plants throughout an otherwise fine turf, detracts seriously from the value of the ground. Further, there is no known method of eradicating these coarse growths apart from hand weeding, which is both laborious and expensive.

We arrive, therefore, at the conclusion that the popularity of this grass for cheaper turf production is likely to wane unless clean seed can be put on the market. This would be unfortunate, especially since this strain is economical of both seed and cost, and home seed-growers who have found how to grow this crop so as to yield heavily for seed (6 cwt. or more per acre) would lose a lucrative crop.

It is on the seed-grower that the chief onus must rest for getting cleaner seed, for if the crop as harvested is contaminated by other grass seeds of similar size and shape, the seed-cleaner can do little towards producing a clean sample. By increasing considerably the wastage of fescue seed it would be possible to remove seeds of perennial ryegrass, Yorkshire fog or cocksfoot, but this would send the price up sharply.

Unwanted Plants should be Rogued It should not be difficult or expensive for the grower of S.59 to overcome this problem. At present, the accepted method is to sow seed in wide rows to produce the maximum yield and allow the maintenance of the crop in a thriving condition for several years. This method also permits inter-row cultivations, and these, obviously, are of the greatest importance in producing a clean crop and clean seed. Most growers carry out these cultivations thoroughly, but more than this is needed. Stray plants of ryegrass or other unwanted species may show up in the drills after spring cultivations have been completed and, unless removed before harvest, they will contaminate the seed crop. The only effective answer to this is to traverse the rows shortly before harvest and remove by hand all plants the seeds of which would be difficult to separate from the fescue during cleaning. The chief offenders are perennial ryegrass, cocksfoot, Yorkshire fog and brome. This task of roguing should be carried out with great care and must, of course, be undertaken every year that seed is taken. Another necessary precaution is to avoid applying yard manure and the feeding of hay on fields shortly due for sowing down to S.59 for seed production.

The fact that S.59 is now utilized almost entirely for turf-making, must alter completely the approach to the production of this seed. Impurities which are unimportant to the farmer requiring this grass for pasture purposes are of serious consequence in turf-making. There is thus everything to be said in favour of the production of S.59 seed by the specialist grower.

THE MARKETING OF SWEET CORN

G. H. STANSFIELD, B.Sc.

Ministry of Agriculture and Fisheries

Sweet corn, or corn on the cob, is a popular dish in America but its consumption in this country, although steady, is small. If it is to gain in public estimation, quality and good packaging are essential. Given these, the crop can give a good return to the grower.

SWEET CORN (*Zea Mays*, var. *saccharata*) is a variety of maize, but the seeds have a higher sugar content and the seed coat is less tough than those of the ordinary maize varieties grown for their starch content. Sweet corn is grown for culinary purposes. The whole cob is cut when still immature, is boiled for about 10 minutes and served, usually with a butter sauce, as a vegetable, savoury dish, or sweet.

Before the last war the consumption of sweet corn in Britain was confined almost entirely to a few hotels and restaurants, but it had for a long time been widely used in the United States and Canada where it is known as "corn on the cob". The presence of American troops in Britain during the war led to an expansion of demand, not only from the Americans themselves, but also from our own people. Wherever American troops have been stationed, they have left a taste and a limited but steady demand for corn on the cob, and, provided the right variety is grown and proper attention is given to harvesting and marketing the crop, there seems to be no reason why this demand should not be extended. The crop is in season in this country from July to October.

Sweet corn is usually grown as a market-garden crop. It can be grown on a variety of soils but does best on a well-manured, medium loam and prefers a sunny situation. Given suitable conditions, it can be grown south of a line drawn roughly from the Wash to the Severn. At present the London market receives supplies from Surrey, Sussex, Kent, Essex, Suffolk, Norfolk Hampshire and Devon. These supplies are consumed mainly in the London area, but there is some re-consignment to northern markets and to Scotland. The total area under the crop is probably less than 100 acres, the largest units being from 5 to 8 acres.

The popular varieties being grown in this country are Canada Cross (syn. John Innes Hybrid No. II), Early Golden Market, Golden Cross Bantam and Extra Early Bantam. Seed of some new American hybrids which would probably be suitable is unfortunately not yet available in sufficient quantity to supply commercial holdings in this country.

Varietal characteristics are not easy to define. Ears of stock-feed varieties of maize, when picked in the "milk" stage of growth, may be difficult to distinguish from sweet corn and this has led some growers to plant "flint" or "dent" corn varieties (e.g., Golden Standard) and sell the ears as sweet corn. This is a very short-sighted policy, which brings discredit on the grower and also prejudices the consumer against the real product. So-called dual-purpose varieties, i.e., for stock-feed and table, are little better than maize, and have not proved suitable for table use.

Harvesting the Crop and Trimming for Market It is essential to market the crop at the correct stage of maturity. There are certain tests which can be carried out at the beginning of the season, after which the picker will be able to assess the marketability of the ears by appearance or "feel". The browning of the silks (i.e., the styles and stigmas) is

a good indication of maturity, but it is important to remember that it is when the silks *begin* to turn brown that the ears are ready for harvesting and that they will remain brown long after the ears are no longer fit for eating. The ears should feel plump to the touch and the outer husks should be a fresh green. The colour of the seeds at the correct stage for marketing as sweet corn should be cream, and they should be unwrinkled.

The thumb-nail-test can provide good indication of maturity. Under moderate thumb-nail pressure the seed coat should break and the contents spurt out with the consistency of thick cream. (When ripe the seeds of sweet corn are wrinkled. It is important to remember that this wrinkling occurs first on the basal seeds and progresses upwards. For market, even the basal seeds should not have started to wrinkle.)

An experienced picker, after examining several ears for maturity as already described, then takes into consideration the browning of the silks, the appearance of the husks and the plumpness of the ear. The ears are picked with a sharp downward jerk, so that the whole ear, complete with shank, is removed cleanly.

After picking, the seed coat hardens rapidly and the conversion of sugar to starch proceeds very quickly. These changes can be retarded by low-temperature storage. Work in America has shown that sweet corn kept at an average temperature of 67°F. will lose by conversion one-quarter of its sugar in twenty-four hours, and that at 85°F. the loss of sugar is twice as great, but if the temperature is maintained at 49°F., only one-eighth of the sugar is lost by conversion during the same period.

There is at present no standardization in the degree of trimming practised by individual growers. Each has its own method ; some are too severe, whilst others market the entire ear as it is removed from the plant ; some remove all but four sheathing leaves, others leave as many husks attached as possible.

An ideal trim is to remove all but one inch of the shank and to retain all the sheathing leaves which then remain firmly attached. The leafy tips of the husks should be carefully removed. This trim looks neat, is sufficient to protect the grain from mechanical injury, and ensures freshness of the inner leaves for display purposes by the retailer.

Grading and Packing Most growers grade for size. Even so, there is considerable difference of opinion between growers as to the sizes of ear which should constitute the grades. According to the majority of growers, a first-grade ear should have 6 inches and over of actual seeds, any which have only 4–6 inches of seed being regarded as second grade.

The United States Department of Agriculture lays down that each ear for the American market shall be not less than 5 inches for the top grades "U.S. No. 1" and "U.S. Fancy".

Owing to the inaccessibility of the grain, little or no quality grading is practised in the packing-house, but one specialist in this country parts the sheathing leaves at the tip of the ear to ascertain that all the seeds are fertilized to the top, and ears which are not so filled are classed as "seconds". There should be one quality grade only and this will be reached if the tests described in this article are carried out when picking the crop.

THE MARKETING OF SWEET CORN

Canada has no recommended grades for sweet corn in the green state, but only for canned sweet corn, owing to the fact that (in their opinion) it is not really possible to give a complete grading for quality without parting the sheathing leaves.

Grading and marketing must be done well to achieve the best market prices. To improve the marketing of home-grown sweet corn, the Marketing Division of the Ministry, acting on the advice of its Advisory Committee on Standard Grades and Packs for Fruit and Vegetables, which is representative of all sections of the horticultural industry, has recommended grades and grade definitions for use by growers and packers of home-grown sweet corn.*

For the purpose of ensuring that the recommended grades are thoroughly practicable, growers and packers of home-grown sweet corn have been asked to send to their usual wholesalers sample packs of sweet corn conforming with the recommended grades. The grades will be modified if they are found to be unsatisfactory in practice.

At present many and diverse kinds of containers are used for the marketing of sweet corn in this country. Both returnable and non-returnable are used, from No. 12 chip basket to half-bushel wooden boxes and Dutch trays. The smaller containers sell more readily, due, no doubt, to the limited trade of any one retailer in sweet corn. The No. 12 chip basket is the best package for sweet corn. It will hold 9–24 ears, according to size. The lid should be of stiff card, affixed by two rubber bands, and may be printed with the consignor's name and address, the variety and, as this product is sold by count, the number of ears in the container.

The shape of the ears makes sweet corn an easy product to pack. They are laid head to tail in alternate layers in the package, lengthways in the smaller packs, and across the box in the larger packages. Blue lining paper is used for returnable boxes, which have no lids but are simply tied across with string through the slatted sides to hold the produce in place.

The production of sweet corn for market is a comparatively new development in this country and the potentialities cannot yet be foreseen. Future demand for the product may be killed at the outset by the marketing of an unsatisfactory product or a good product in unsatisfactory ways. If public confidence in this excellent commodity is to be established, it is essential that only true sweet corn varieties, free from maize characteristics, should be grown. The seed of the hybrid crosses must be raised each year by specialists and should not be saved by the grower for use in another year.

Grading and packing must be of the highest standard to secure the best market prices. Properly packed and marketed, the crop gives a handsome return. It has been estimated that an acre of sweet corn costs approximately £50 to grow. The return, varying with conditions, may amount to £200–£500 per acre.

Advice on the cultivation of sweet corn is given in Advisory Leaflet No. 297.

* Details of the grade designations and quality definitions are contained in Marketing Guide No. 38, *Sweet Corn*, copies of which can be obtained free from the Ministry(Marketing Division), 36-38 Chester Terrace, Regent's Park, London, N.W.1.

FARMING AFFAIRS

Ploughing Up Grassland Although arable farming has been greatly improved and developed in recent years, grass is still a rather weak link in the cropping chain. Henceforth, the scheme of contributions towards the cost of fertilizers will apply only to old grassland and to rough grazings. It is hoped thus to encourage the breaking up of more grassland with a view either to better grass by reseeding or to an increase in the tillage area. In the early years of the ploughing-up campaign crops were often damaged by wireworms. No chemical method of controlling this pest had then been discovered, but it was already known, and fully confirmed later, that some crops are less susceptible to attack than others and that damage is likely to be mitigated by thorough cultivation, consolidation and the judicious use of fertilizers. As additional safeguards there are now available (1) a chemical (BHC) protective dust for application to the soil before or at the time of sowing cereals, and (2) a cereal seed dust dressing which protects from wireworms and the more common seed-borne fungus diseases as well. But these dressings will not enable the farmer to neglect cultivations and fertility.

The first desideratum, as a rule, is a well-broken seedbed with no hollows beneath the furrow slices. When grass is broken for the first time the corn crop is generally best on the headlands. The seedlings appear there first and best maintain their density afterwards. If the whole field could be worked as the wide surrounds are worked by tractor and trailed implements, there is no obvious reason why the stand of plants should not be equally good throughout the field. The disc cultivator is the most efficient implement to this end, but even for autumn sowing the ring roller as well need not be ruled out so long as the soil is not too wet. The seeding rate may usually with advantage be slightly increased, and cross-drilling, or even broadcasting where the circumstances permit, gives a better plant distribution and fewer gaps in the rows which are so characteristic of wireworm attacks.

Although the damage is usually greatest when permanent grass is broken up, crops grown after long leys may also be attacked. Of all crops, cereals seem to the most susceptible to damage. Barley, however, is safer than wheat or oats. Beans and tares rarely take any harm and, for some unexplained reason, the wireworm population seems to drop appreciably after a bean crop. Thus winter beans or a cereal-legume mixture may sometimes be substituted for a cereal in autumn sowings.

If land is of low fertility, as much old grassland obviously is, the consequently slow development of the cereal crop renders it very susceptible to injury. Advantage should certainly be taken of the subsidy to supply adequate fertilizers and, if necessary, lime. Finally, the crop should be sown as early as possible. Even if there may be some attack by wireworms in the autumn, a strong plant will commonly succeed in overcoming it.

J. G. Stewart

Farming Cameo : 11. The Huddersfield District Of the many farming types in the West Riding of Yorkshire, an area characteristic of the Pennine industrial region is to be found around and to the south and south-west of Huddersfield.

Farming here is affected by a variety of conditions, notably : a relatively

high rainfall, the hilly nature of the land, the inherent acidity of the soil, the industrial activity of the district, the small size of the farms and of the fields, and the difficulty of access to both homesteads and fields.

The district is intersected by deep valleys, where the large population is engaged mainly in the woollen industry. From the valleys the land rises sometimes steeply, sometimes gradually, to the hill tops, but all that is undeveloped industrially is farmed in some way or another. Here land is at a premium and there is keen competition for any holding that becomes available to let or to sell. Most of the holdings close to the thickly populated centres are engaged in milk production, and a high proportion of the farmers are producer-retailers, a few of them rear a small number of calves in addition. As one ascends the hillsides, and as access to the farms becomes more difficult, either by distance or by reason of steep, narrow, rough occupation roads, milk production gradually gives way to stock rearing, although even on some of the least accessible farms it is surprising to find milk still being produced. Most of the farms are very small—10–50 acres ; a 100-acre holding is comparatively rare.

Another feature of this district is the small size of the fields—less than 2 acres very often—and the dark grey walls built of Millstone Grit rock.

Nearer the hill-tops and adjoining the unenclosed moors are the stock-rearing and sheep farms. Most of the sheep in the district spend the greater part of the year on the open moors but come down to the in-bye or pastures for tupping and again for lambing. The breeds, which must be hardy to survive winter on these hills, consist mostly of Lonks, Derbyshire Gritstones and Swaledales.

It must not be thought that the land in the district is all unworkable. On the contrary, there are large areas of good cultivable land, and since 1939 the plough has been surprisingly active in turning over old grass, composed mainly of bent, creeping soft grass, moor mat grass, wavy hair grass or even bilberry. Admittedly, the difficulties in many instances have been great, and not the least of these are the small size and steepness of the fields, the presence of rock, and the natural acidity of the soil, together with the combined effects of a high rainfall and the deposits from industrial fumes. Under these conditions the *p*H is commonly as low as 4.2–4.5, and the lime requirement as high as 35–45 cwt. CaO per acre.

On land used for arable cropping a rotation frequently adopted is oats–roots–oats–seeds–seeds, for here the farmer's main concern is to provide as much food as he can for his dairy and store stock. In spite of this, however, many farmers have made a small but useful contribution to the potato acreage by growing an odd field or so for their own use and for a small local trade.

Being a high rainfall area, oats and roots are the most suitable arable crops, and excellent yields are obtained. During wet harvests, however, the losses in spoiled corn and hay are heavy, and there is growing interest in silage-making for the greater security it gives as a fodder conservation process.

A wet summer, however, normally suits the pastures and helps the re-seeding programme. A great deal of ploughable land, although incapable of being cropped in rotation, has been reseeded direct. In this district the Aberystwyth grasses have given a good account of themselves. There is much evidence to show that on this type of land, fertility must be maintained at a proper level, otherwise sward quickly reverts to its original state.

FARMING AFFAIRS

The Huddersfield district is one where, if the farmer is to achieve a reasonable return from the land, he must be prepared to tackle its vagaries, supply its many needs and contend with the elements. If he does this there is then perhaps no land in the county which will show a more spectacular response.

J. Jones,
Assistant County Agricultural Officer

The Dolhendre Scheme A tangible commemoration of the Festival of Britain has been made by the members of the Welsh Festival Committee, who decided to contribute towards a scheme of rural reconstruction in Wales, under the aegis of the Welsh Land Sub-Commission and the Forestry Commission. The story of this interesting experiment is told in *The Dolhendre Scheme** published by the Festival of Britain Welsh Committee.

The scene of the experiment is the hamlet of Dolhendre, part of the Glanllyn Estate in the heart of N. Wales, which was handed over to the State in 1946 in lieu of death duties and is now administered by the Welsh Land Sub-Commission.

Dolhendre comprises three farms and a derelict cottage, all built of stone in the traditional style. Under the scheme, the farms were to be rehabilitated, the land improved, the farm buildings modernized and new buildings erected. Some of the land was to be afforested and, with the co-operation of the Merioneth County Council, the road from Dolhendre to the main Bala-Dolgelley road, improved. In addition, the derelict cottage was to be restored and modernized, and four new houses erected as a first instalment for the housing of forestry workers.

The idea behind the scheme, which it is hoped in time to extend to the whole of the Glanllyn Estate (a beautiful area of some 39,000 acres), is to encourage an increase in the total rural population which has become sadly depleted over the years.

The improvements to the farm houses include the provisions of piped water and electricity, and new kitchen ranges and bathrooms, and to the farm buildings, the erection of calf-boxes, implement sheds and dairies, as well as other items of reconditioning. In all these arrangements the tenants have been consulted about their particular requirements. Advantage has been taken of the Hill Farming Act for the improvement of such land as qualified for grant.

The afforestation scheme, which will lead to an increase in the rural population as the years go by, will cover the replanting of areas of old woodland and the planning of new.

The Committee hopes that in this experiment in rural reconstruction, which is part of a larger scheme to improve the quality and range of life in the neighbourhood, will be found a stimulation towards the restoration of local rural life on a firm foundation.

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* Obtainable from the Committee Office, 2 Cathedral Road, Cardiff. Price 1s.

Hop-Picking Machines An interesting account of a preliminary survey of representative hop-picking machines is given by J. A. C. Gibb and G. P. Chater in the 1950 Annual Report of the Department of Hop Research at Wye College.* The main objects of the survey were to ascertain the standard and rate of picking by machine, the amount of hop wastage, and the labour requirements. Although the details vary considerably, all hop-picking machines work on similar lines, different sections of the machine carrying out different processes in a definite sequence. Particulars are given of the feeding and picking mechanism, the lateral pickers, the petal, leaf and strig (i.e., stemmy rubbish) separators, and the manual cleaning conveyor. The machines are normally driven by electricity at anything from 20 to 60 h.p.

The simplest picking device in the machines covered by the survey consisted of stationary wire combs, over which the bine was pulled either by hand or by a mechanical conveyor. One machine employed the principle of suction combined with the action of a circular knife. Another type had a spring-tined rotating cylinder, with two series of spring steel fingers rotating in opposite directions. Separator devices included the use of a wire mesh, powerful fans and a perforated roller with suction.

The report contains some interesting figures recorded from six machines and from three hand-picked samples. Typical hand-picked hops resulted in 73 per cent whole hops, 20 per cent broken hops, 5 per cent leaf and 1 per cent rubbish, the corresponding figures for a typical machine-picked sample being 51, 35, 7 and 7 per cent respectively. With a badly machine-picked sample, the figures for whole hops can fall as low as 36 per cent with 47 per cent broken hops.

The management of the machine can determine the quality of the resulting sample of hops, since by reducing the rate of throughput, the picking and separating devices will work more gently and the proportion of broken to whole hops is reduced. Considerable differences in efficiency of the gangs operating the machines were seen in the machines surveyed, and there were variations in the distribution of labour.

The total labour force employed on the machines varied between 23 and 44, and the output of hops per day per machine ranged from 192 to 409 10-bushel sacks.

It is felt that no rigid conclusions can be drawn from the survey owing to the small number of machines investigated and the fact that machines of all types are still developing, but the account is a useful guide to the results that can be expected and the amount of labour required.

Potato Root Eelworm : Tuber Washing Trials In February, 1950, an experiment was undertaken at the Peterborough Sugar Beet Factory by entomologists of the Ministry to investigate the possibility of the removal of potato root eelworm cysts from seed potatoes by washing—using the facilities kindly placed at their disposal at the factory. The tests were planned to obtain information on the efficiency of the washing method, the amount of damage to tubers, the adverse effect on sprouting, and the possible spread of Dry Rot. An experimental washing machine designed to wash sugar beet free from dirt was used. Its main components were two revolving cylinders, the first having one end immersed in flowing water and the second provided with very strong water jets.

* Obtainable from the Secretary, Wye College, nr. Ashford, Kent. Price 4s.

Three varieties were used : Arran Consul, a deep-eyed variety ; Majestic, a shallow-eyed variety ; and Arran Pilot a variety susceptible to Dry Rot. The tubers were obtained from eelworm-infested land and were examined beforehand to estimate the numbers of cysts present. Four hundredweight of each variety was washed in the first and second drums, 4 cwt. washed in the second drum only, and 4 cwt. retained as control. After washing, 3 of the 4 cwt. of each variety was sent to Sutton Bonington to be tested for keeping quality and chitting. The remaining hundredweight of each was kept for examination for cysts at the Cambridge National Agricultural Advisory Service centre.

The results showed that the potatoes put through both washing drums were almost, but not completely, freed from cysts. Washing in one drum only was slightly less effective. The observations on bruising showed that as the washing efficiency improved the risk of damage to tubers increased, and that although washing appeared to have little effect on sprouting, it led to a substantial increase of Dry Rot in Arran Pilot, the variety susceptible to this disease.

It was concluded that although it is possible with extreme care and very efficient washing to reduce to a low level the numbers of eelworm cysts present on infested seed potatoes, it is not an economic practice. The decision to adopt a washing method at any particular centre or centres would inevitably mean the construction of special washing and drying equipment and heavy freight and handling charges. There would also be an additional increase in cost due to losses from bruising and Dry Rot. If, by the use of a washing method, it were possible to guarantee removal of all cysts, the method, even with so many drawbacks, might have been worth while. Lacking complete efficiency, it is felt that other methods must be sought and work should probably be concentrated on fumigation for killing cysts rather than on a mechanical method for removing them from infested tubers.

THE MINISTRY'S PUBLICATIONS

Since the date of the list published in the June, 1951, issue of AGRICULTURE *(p. 146), the undermentioned publications have been issued.*

MAJOR PUBLICATIONS. Copies are obtainable at the prices mentioned from the Sales Offices of H.M. Stationery Office or through any bookseller.

Bulletins

No. 4	Bush Fruits	(*Revised*)	2s.	(2s. 1½d. by post)
No. 36	Manures and Fertilizers	(*Revised*)	3s.	(3s. 2d. by post)
No. 44	Narcissus Culture	(*Revised*)	2s. 6d.	(2s. 8d. by post)
No. 87	Beans	(*Revised*)	2s.	(2s. 1½d. by post)

Other Major Publications

Toxic Chemicals in Agriculture : Report of the Zuckerman Working Party (*New*) 1s. (1s. 1½d. by post)

LEAFLETS Up to six single copies of Advisory and Animal Health Leaflets, may be obtained free on application to the Ministry (Publications), 36-38 Chester Terrace, Regent's Park, London, N.W.1. Copies beyond this limit must be purchased from a Sales Office of H.M. Stationery Office. Copies of Fixed Equipment of the Farm Leaflets are obtainable as for Bulletins (see above).

Advisory Leaflets

Group I. Livestock and Dairying

No. 29 Circumstances affecting the Composition of Milk (*Revised*)

Group V. Weeds

No. 371 The Control of Hoary Pepperwort (*New*)

MINISTRY'S PUBLICATIONS

Animal Health Leaflets

No. 38 Lamb Dysentery (*New*)

Fixed Equipment of the Farm Leaflets

No. 11	Farm and Estate Hedges	(*New*)	1s.	(1s. 1½d. by post)
No. 12	Farm and Estate Roads	(*New*)	9d.	(10½d. by post)
No. 13	The Cattle Crush	(*New*)	4d.	(5½d. by post)
No. 14	Sheep-Dipping Baths and Handling Pens	(*New*)	6d.	(7½d. by post)
No. 15	Shelter Belts	(*New*)	9d.	(10½d. by post)
No. 16	The Bull Pen	(*New*)	6d.	(7½d. by post)

FREE ISSUES. Obtainable only from the Ministry (Publications), 36-38 Chester Terrace, Regent's Park, London, N.W.1.

Smallholdings Buildings Manual (*New*)
Fertilizers: Corn (*New*)
Fertilizers : Grass (*New*)

Attention is drawn to the recent increase in the price of some of the Ministry's leaflets. The old and new prices are quoted below :

	Old Price	*New Price*
Advisory and Animal Health Leaflets		
Each	1d.	2d.
Per dozen	9d.	1s. 6d.
Fixed Equipment of the Farm Leaflets		
Each	3d.	{ To be priced individually
Per dozen	2s. 6d.	{ for each issue

The new prices for leaflets already issued will come into effect on reprinting.

AGRICULTURAL INDEX NUMBERS

MONTHLY INDEX NUMBERS OF PRICES OF AGRICULTURAL PRODUCTS

INCLUDING EXCHEQUER PAYMENTS (UNCORRECTED FOR SEASONAL VARIATION)

BASE 1927-29=100

	1951			1950		
	April	May	June	April	May	June
All Products	251	231	234	233	212	211
Cereals and Farm Crops	270	278	285	239	241	240
Livestock and Livestock Products	244	214	217	230	201	200
Wheat	284	287	290	251	252	252
Barley	336	339	328	234	239	236
Oats	277	294	298	226	231	227
Potatoes	236	248	265	236	236	236
Hay	254	258	257	215	221	220
Fat Cattle	257	258	248	233	236	228
Fat Cows	207	207	215	186	187	194
Fat Sheep	239	239	233	235	235	222
Fat Ewes	224	218	209	221	215	194
Bacon Pigs	346	346*	346*	305	316	312
Pork Pigs	296	296	296	269	269	269
Sows	235	235	235	228	228	228
Milk	245*	189*	188*	235	178	178
Butter	114	125	143	91	105	105
Poultry	318	299	272	240	257	255
Eggs	193	193	229	206	206	206
Store Stock †						
Dairy Cows	177	179	181	162	163	167
Store Cattle	222	231	232	214	214	210
Store Sheep	268	280	286	231	234	261
Store Pigs	438	450	461	375	403	410

* Provisional.
† Not included in general index.

N.B. Agricultural Index Numbers given in previous issues of this JOURNAL have recently been revised with some small changes. Details of the revised numbers may be obtained from the Ministry's Horticulture and Price Statistics Branch, 36 Chester Terrace, Regent's Park, London, N.W.1.

AGRICULTURAL STATISTICS : ENGLAND AND WALES

GLASSHOUSES

(FINAL RESULTS) 1950–51

DESCRIPTION	Glasshouses (*a*)				Frames, Lights, Bells, Cloches etc. (*a*)			
	Square feet (000)		Equivalent Acreage (*b*)		Square feet (000)		Equivalent Acreage (*b*)	
	1950	**1951**	**1950**	**1951**	**1950**	**1951**	**1950**	**1951**
TOTAL AREA UNDER GLASS								
With heating apparatus	160,991	169,729	3,696	3,896	—	—	—	—
Without heating apparatus	25,713	27,803	590	638	—	—	—	—
TOTAL	**186,704**	**197,532**	**4,286**	**4,534**	**24,168**	**25,440**	**555**	**584**
CROPS UNDER GLASS								
Lettuce	24,147	21,409	554	491	7,926	6,490	182	149
French Beans	(*c*)	258	—	6	(*c*)	19	—	—
Mushrooms	(*c*)	1,588	—	36	(*c*)	58	—	1
Other Vegetables and Herbs	4,038	3,136	93	72	2,382	1,498	55	34
Tomato and Cucumber Seedlings	14,548	12,856	334	295	30	35	1	1
Carnations	4,156	5,911	96	136	34	31	1(*d*)	1
Roses	2,438	3,127	56	72	7	6	—	—
Orchids	366	421	8	10	1	2	—	—
All other Flower and Foliage Crops	16,305	23,476	374	539	2,120	2,686	48	62
All other Crops not specified above	8,047	6,279	185	144	1,572	1,651	36	38
Remaining Glass Area, being the area unused at January 15, 1951, or used for other purposes not shown above	112,659	119,071	2,586	2,733	10,096	12,964	232	298
TOTAL	**186,704**	**197,532**	**4,286**	**4,534**	**24,168**	**25,440**	**555**	**584**
	1949	**1950**	**1949**	**1950**	**1949**	**1950**	**1949**	**1950**
CHRYSANTHEMUMS								
Area at December 1	20,346	26,562	467	610	331	407	7	9

(*a*) Holdings with less than 1,000 sq. feet of glass were not included in the January, 1951 census, and the published figures for January, 1950 have been amended to exclude such holdings. (*b*) Calculated to the nearest acre. (*c*) Not separately recorded. (*d*) Please note corrected acreage ; given in last year's results as "nil".

BOOK REVIEWS

The Shepherd's Guide. Compiled by J. RUSSEL GREIG. H.M. Stationery Office. 3s.

In these times when the scarcity of meat in this country is very marked, the necessity to guard our flocks and herds against disease is extremely important, and any information on the subject is to be welcomed. Dr. J. Russel Greig, whose work on, and interest in the health and diseases of sheep is so well known, has therefore written this "guide" at a most opportune time. The introduction states that the only guide in existence was written in 1807 by James Hogg, the Ettrick Shepherd. It was time, therefore, that another guide was produced, for during the interval of 144 years our knowledge and understanding of sheep diseases have progressed along scientific lines to a stage when we are in a position to make definite statements on causes and methods of control. Much of the work has been carried out by the Animal Diseases Research Association since its founding in 1920. It is gratifying to see how much exact knowledge has accumulated in the 30 years since that date.

This book is stated to have been written for the guidance of the shepherd. It will certainly fulfil its purpose, but there is little doubt that it will appeal to all who are interested in sheep. It is written in such a style that it is easily read ; the various diseases are dealt with in a clear, concise manner, but at the same time all the salient points are included. The scientific matter is dealt with in an interesting and simple way which makes it easy to understand and appreciate.

Although a number of the diseases discussed in the book are found mainly in hill sheep, there is also a mass of information which applies to sheep all over the country. The translations of the names of diseases into Gaelic and Welsh add to the value of the contents, for many of the diseases are recognized by local names in areas where English is not always spoken.

I can confidently recommend this book to all interested in sheep ; it contains a mine of information which will be of value—from the care of hypodermic syringes to the diseases which have demanded much research work.

Undoubtedly, as time goes on, new information will be added and further editions published. Sheep disease research is progressing all the time and we can look forward to the new editions to keep us up to date.

T.D.

Plant and Animal Nutrition in relation to Soil and Climatic Factors. Proceedings of the Specialist Conference in Agriculture. Australia, 1949. H.M. Stationery Office. 20s.

It has become more generally obvious during the past few years that agricultural problems are not necessarily as local in their occurrence as previously assumed. Individual agricultural research workers have recognized this for some time and have carried on correspondence with their colleagues abroad, but there has been only slight organization of such useful collaboration until the British Commonwealth Scientific Conference recommended in London in 1946 that specialist conferences of research workers in specific subjects should be called to discuss fully the closer integration of British Commonwealth research work. The first of these was held in Adelaide in August, 1949.

The report of the proceedings, now published, contains the complete text of all the papers read, together with the summaries made by the chairmen of the various sessions. The influences of climate on soils, of soils on plants, of plants on animals, of animals on plants, of animals on soils and soils on animals all receive attention, and the book has a special value in bringing together all these aspects more completely than before.

Naturally the effects of copper and cobalt deficiencies and of molybdenum and copper excesses on the health of animals receive full treatment, since it is to Australia and New Zealand that workers have looked as the cradle of this subject. The series of papers on the interrelationship of pastures and animals shows, as one would expect, the strength of the New Zealand work on grassland and its utilization. To the worker in a maritime temperate climate the influence of continental climates ranging from temperate to tropical provokes a new outlook on familiar phenomena.

The volume is a valuable compendium of the state of knowledge on much of agricultural research and contains information not easily found elsewhere.

The omission of any kind of index —even of the titles of papers—prevents ready reference to individual papers, but familiarity with the contents, which will come readily from browsing, will soon overcome this defect. Most of the papers carry a full bibliography.

J.B.E.P.

BOOK REVIEWS

Kent (Vision of England Series). REGINALD TURNOR. Paul Elek. 15s.

"Writing of any county, one must start with an imaginative picture, however vague; and proceed to detail and clarify it, filling in the broad pattern with historical, topographical, and architectural motifs which are intended to make it graphic and, as it were, mentally portable." So says Mr. Turnor in the first chapter of his book. The author is clearly an authority on architecture and local history, and has accomplished his task well. His home is at Ide Hill, on the sandstone ridge west of Sevenoaks, overlooking the Weald of Kent, and he is obviously enthralled by the natural charm of the county.

In a round tour Mr. Turnor explores thoroughly the highways and by-ways of Kent, discovering and expertly describing the architectural features and historical associations of the various places he visits. Like all true Men of Kent and Kentish Men, he is very proud of his county, and Kentish readers in particular will be interested in the claim that "with a great share of its lands belonging to the Church, and the only possessor of two bishoprics," Kent is the most Christian county in England, and the people "the most civilized of Englishmen, if only by reason of being the most continental".

Seventy-four excellent photographs focus pictorial interest and are supplemented attractively by 35 wood engravings by Monica Poole, as well as a very interesting old map of the county engraved in 1611 by John Speed, with an inset showing the streets and buildings of the city of Canterbury at that time. A good index adds to the value of this well-produced and enchantingly written book.

G.H.G.

The Carnation Year Book, 1950. British National Carnation Society. 7s. 6d.

Always an eagerly-awaited annual among those issued by the specialist horticultural societies, the 1950 Year Book of the British National Carnation Society more than lives up to expectations.

This year it runs to 125 pages, some 25 more than last year, and all of them have been put to good use. The really remarkable feature of the Society's achievement is how thoroughly the interest is balanced—there is something to interest the novice grower; there is much to interest the old hands; and even those whose knowledge of the carnation is entirely theoretical would not find this book amiss on their shelves. Similarly, both professional and amateur alike seem to be at home in the pages.

Besides dealing with the whole range of carnations and pinks from every worth-while aspect, there is also a reference to the new methods of growing in sand and gravel. This now seems to have become an established feature of the Year Book.

A prominent place is given to the work of newcomers to the carnation field. Especially interesting is an article by Mr. J. R. Beckett on growing in New Zealand.

The book is handsomely illustrated and attractively printed, although from the editorial standpoint an improvement might be to present the items in a more orderly fashion—by keeping all the personal items together, for instance.

C.T.

Soilless Cultivation of Perpetual Carnations (2nd Edition). British National Carnation Society. 5s.

Issued in response to many requests, the Carnation Society's new and revised edition of their booklet on growing perpetual flowering carnations without soil is a very welcome addition to the literature for those interested in the subject. Besides incorporating practically all the previous material, a number of valuable reports on the later aspects are included, making the work as comprehensive as possible in a publication of this size.

Foremost among the new material, perhaps, is Mr. S. R. Mullard's contribution on growth in vermiculite, the latest medium for use with nutrient solutions, for which several advantages are claimed. Mr. F. Hicks, the expert in sand cultivation, also offers some original ideas, among them the ingenious way in which he has overcome the problem of suitable large-scale containers.

Among the new contributors Mr. R. J. Morton, whose name is familiar in the gardening press, goes so far as to declare that sand culture is better and easier for amateurs than growing in soil.

One general criticism could be made—that while interesting and stimulating, the information given is not in sufficient practical detail to be as valuable as it might be.

C.T.

BOOK REVIEWS

Cereal Varieties in Great Britain. R. A. PEACHEY. Crosby Lockwood. 21*s*.

Written as a guide and source of information for farmers, seedsmen, Crop Inspectors and students, this book covers the three cereals, wheat, oats and barley. At the beginning of each section, a general account is given of the features which should be taken into account when choosing varieties of these cereals for particular conditions. There is also a good general summary of their botanical characteristics.

Particulars are given of 67 varieties of wheat, 61 varieties of oats and 18 of barley. For each variety there is an account of its origin, general suitability, and principal botanical features. The varieties have been studied by the author mostly in trial grounds in the West Midlands, though the results of the trials of the National Institute of Agricultural Botany are covered in many of the summaries.

Each variety is illustrated by a photograph, but unfortunately these are too general to be used for the identification of varieties. For wheat and barley an attempt has been made to show some of the distinguishing features, but the photographs and drawings are too small and indistinct to show the essential differences between varieties. Those wishing to give serious study to the principal varieties of wheat and barley would do well co consult more detailed descriptions, such as those given in Dr. Earnshaw's bulletin, published in 1949 by the N.I.A.B.

The recommendations of varieties are in some cases based on results of regional rather than national trials and it is doubtful whether, for instance, the comments on Aberystwyth S.172 would hold good respecting many of the districts where winter oats are principally grown. References to diseases and rust resistance are in many cases too general to guide the discriminating grower, and the information on some of the rarer varieties is naturally scanty. The book could have been shortened to some extent if varieties which are very similar (e.g. Golden Rain and Golden Rain II, Scandia and Scandia III) were treated as single types, with brief notes on differences. The range of varieties is somewhat arbitrary; for instance, two pages are devoted to Squarehead's Master (or Standard Red) wheat, but no mention is made of the older stocks of this variety found in various parts of the country.

There are a few errors and omissions which will no doubt be corrected in later editions; for instance, the N.I.A.B. is given as the breeder of Resistance oats, the Welsh name of S.75 oat is incorrectly spelt, and the account of the introduction of Orion III is misleading.

This is a book which can be recommended to the student who proposes to go more fully into the distinguishing characters by practical study. To the farmer and seed grower and others, such as millers and malsters who handle cereal grains, it provides a useful source of general information on most of the varieties they may encounter at the present time, and others which are now rarely seen outside museum collections.

F.R.H.

Silos and Silage (2nd Edition). H. I. MOORE. Farmer and Stock-Breeder. 10s. 6d.

This is a new edition of a book which first appeared ten years ago. As the author says, the need for increased silage-making is no less now than then ; silage can be the answer to many who are seeking a way to overcome scarcity of feedingstuffs in an economical way. Professor Moore, by virtue of his ability to present the results of his practical experience in a most readable form, is well fitted to act as a guide, and his wide public will not be disappointed by this book.

Silage in the routine of the farm is first discussed, and objections to it are considered and answered. " Ensiled crops are riches banked against the many misfortunes that can beset the farming enterprise." This chapter is persuasive, and the reader has to agree that " it is not simply *desirable* to make silage—it is *essential*". The fundamental changes occurring in the crops during the process of making, the various processes available, the causes of faults and their avoidance, and the value of keeping records, are described in the second chapter. This is followed by one on crops suitable for ensilage and their relative values. The handling of the crops in the field, the types of silo which may be employed, and the details of the ensiling process, are dealt with very adequately in three chapters, which are profusely illustrated with photographs and diagrams. To one seeking sound instruction in the job, this part of the book will prove most valuable. The last two chapters deal with feeding silage to stock and the economics of its production.

The book is not without some slight defects but these do not detract greatly from its value. When one is accustomed to thinking in technical short-cuts it is very natural to quote percentages (as in the table on p. 12 and in the Record Sheet on p. 23 and again on pp. 32 and 94) without making it clear that they refer to the *dry matter* and not to the fresh material, but the less knowledgeable can be misled. It is also misleading, as well as

meaningless, to insert the unit "lb." in the table on p. 13 after stating (correctly) that the figures are purely relative. Judging colour must always be a subjective operation, but surely a typical butyric silage could not be fairly described as *yellowish*-green ? Confusion also exists in the feeding guide on p. 95 where, under "Medium" Protein Silage, the symbols M and P are defined although they have not been employed. The confusion has arisen from the unhelpful expansion of "$\frac{1}{2}$M + 1P" to "$\frac{1}{2}$ Maintenance + 1 Production." On the other hand, they are used in the self-contained Table 11 without explanation. It is doubtful, also, if this admittedly intricate table has been set out in such a way as to make its use clear. Finally, the N.A.A.S. Nutrition Chemist is willing not merely to determine *p*H and protein but also dry matter, and so save the hapless farmer from conjugal wrath should he think of misusing the kitchen oven as suggested on p. 93 !

The production of the book is admirable ; the paper is of excellent quality and the printing is flawless ; among several improvements on the first edition is the inclusion of a useful index. The book can be recommended without reserve to anyone anxious for sound instruction in the technique of silage-making.

S. M. B.

Electricity in the Home and on the Farm. FORREST B. WRIGHT. John Wiley. 32s.

It is always difficult to devise a simple yet satisfactory method of explaining to the non-technical reader just how electricity works. This part of Mr. Wright's book gives one of the closest approaches to satisfaction on this score and, provided the reader has some one really technical to whom he can refer certain points probably incapable of "simple" explanation, he should obtain a fair picture of the everyday working of electrical equipment. Indeed, the book may well be regarded as a text-book to be read complementarily with a simplified course of instructional lectures. Electrical engineers and agricultural machinery officers faced with the necessity of including in an agricultural machinery course a few periods on electricity may also find it useful.

Mr. Wright deals in a lively way with the different types of electric motors and their working characteristics—an account that will meet the needs of many who are puzzled about these differences—and the notes on the care and maintenance of motors are well worth studying by any farm mechanic.

But when the author goes on to deal with wiring and wiring fittings, as he does in some detail, he is dealing with essentially American conditions, which are rather different from those found in this country. There is not the same need in this country to encourage "home wiring" as in America, where skilled help may be scarce ; and, in any case, the attainment of complete safety in wiring calls for much more than book guidance can give. The British reader should therefore bear these points in mind.

C.A.C.B.

Annual Report of the Forestry Commissioners, 1950. H.M. Stationery Office. 2s. 6d.

The thirty-first report of the Forestry Commissioners just published contains full details of the progress of afforestation in Great Britain during the past twelve months, and a number of appendices giving various statistical information relating to forestry operations. Several maps showing the distribution of forest conservation in England, Wales and Scotland are included.

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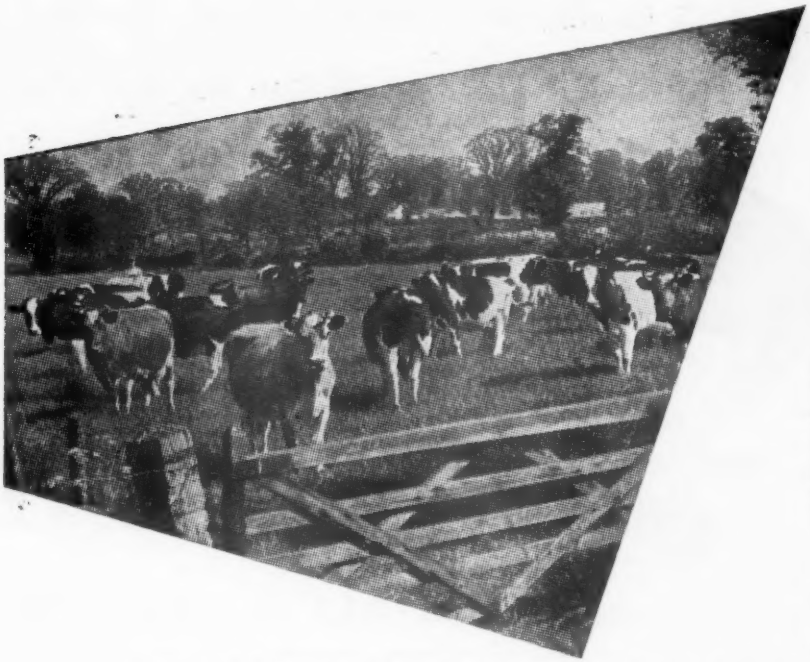

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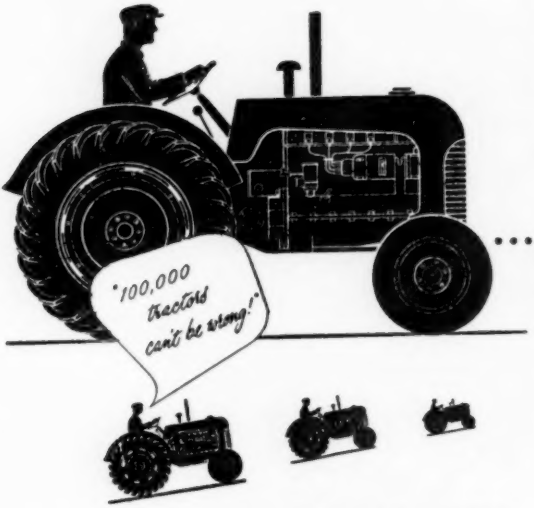

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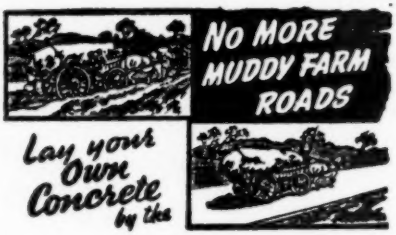

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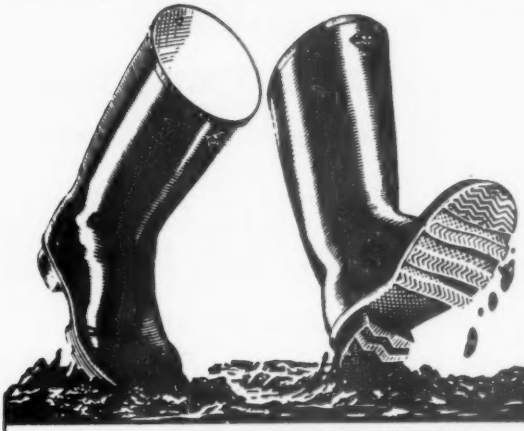

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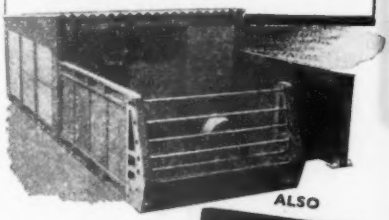

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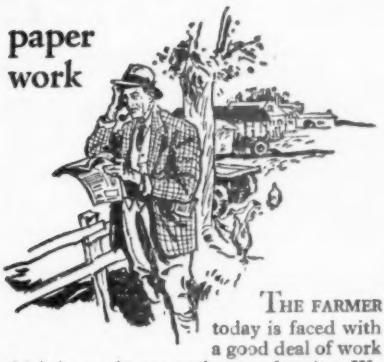

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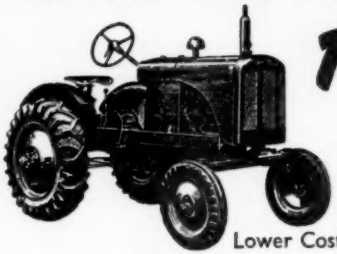

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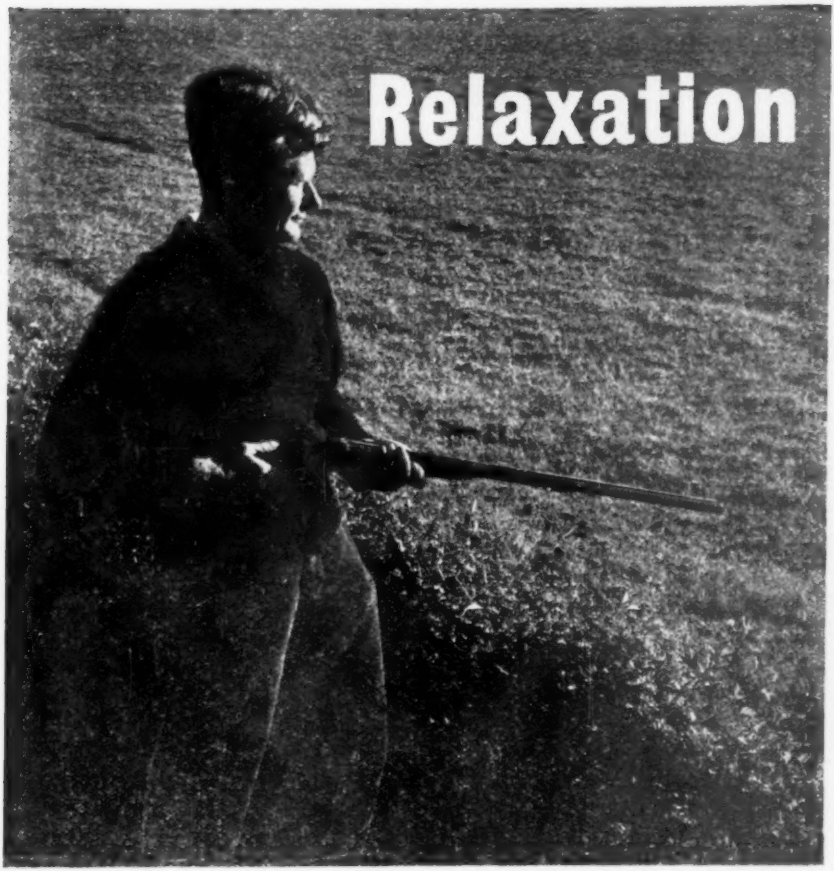

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